INFECTION CONTROL GUIDELINES

FOR

OCCUPATIONAL HEALTH IN HEALTH CARE

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Draft # 11

This draft is a working document and is circulated for the purpose of review and feedback ONLY. The contents will continue to change during the revision process. Therefore, the Division of Nosocomial and Occupational Infections should be consulted before using any part of this draft. Finally, if any part of this document is used, Health Canada must be credited as the sources.

Division of Nosocomial and Occupational Infections
Bureau of Infectious Diseases
Centre for Infectious Disease Prevention and Control
Population and Public Health Branch
Health Canada

Infection Control Guidelines for Occupational Health in Health Care

Introductory Statement

The primary objective in developing clinical guidelines at the national level is to help health care professionals improve the quality of health care. Guidelines for the control of infection are needed to assist in developing policies, procedures and evaluative mechanisms to ensure an optimal level of care. Guidelines, by definition, are directing principles and indications or outlines of policy or conduct that should not be regarded as rigid standards. Guidelines facilitate the setting of standards but respect the autonomy of each health care setting and recognize the governing body's authority and responsibility of ensuring the quality of care provided by the health care setting. Health care settings should also be aware of the regulations and policies in their local and provincial/territorial area regarding infectious diseases.

The Health Canada infection control guidelines, whenever possible, have been based on research findings. Sometimes published research is insufficient and the consensus of experts in the field has therefore been used to provide guidelines specific to conventional practice[1]. The information in these guidelines was current at the time of publication; it should be emphasized that areas of knowledge and aspects of medical technology advance with time. Both encouragement of research and frequent revision and updating to keep pace with advances in the field are necessary if guidelines are to achieve the purpose for which they have been developed.

The Steering Committee acknowledges, with sincere appreciation, the many practicing health professionals and others who contributed advice and information to this endeavor. Health Canada is especially appreciative of the time and expertise contributed by the Subcommittee for the *Infection Control Guidelines for Occupational Health in Health Care* that worked diligently and successfully to develop these extensive guidelines.

The guidelines outlined below are part of a series that has been developed over a period of years under the guidance of the Steering Committee on Infection Control Guidelines. *Infection Control Guidelines for Occupational Health in Health Care* presents an overview and provides recommendations to assist in the prevention and management of health care worker exposures and infections in health care.

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1 See Appendix I: Guideline Evidence Based Rating System

This document is part of the Health Canada series of *Infection Control Guidelines* and replaces the *1990 Infection Control Guidelines for Occupational Health in Health Care Facilities*. It is intended to be used with the other *Infection Control Guidelines* and relevant Health Canada documents that are published in the Canada Communicable Disease Report (CCDR) which include2c:

- *Infection Control Guidelines: Routine Practices and Additional Precautions for Preventing Transmission of Infection in Health Care* (Revision of Isolation and Precaution Techniques) (1999) (1)
- *Infection Control Guidelines for Creutzfeldt-Jakob Disease (CJD) in Canada* (In Press) (2)
- *Infection Prevention and Control Practices for Personal Services: Tattooing, Ear/Body Piercing, and Electrolysis* (1999)
- *Hepatitis C - Prevention and Control: A Public Health Consensus* (1999) (3)
- *Proceedings of the National Varicella Consensus Conference* (1999) (4)
- *Canadian Immunization Guide, Fifth Edition* 1998(5),
- *Proceedings of the Consensus Conference on Infected Health Care Workers: Risk of Transmission of Bloodborne Pathogens* (1998) (6)
- *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings* (1997) (7)
- *An Integrated Protocol to Manage Health Care Workers Exposed to Bloodborne Pathogens* (1997) (8)
- *Hand Washing, Cleaning, Disinfection and Sterilization in Health Care* [Revision of Part V - Hospital Environmental Control] (1998) (9)
- *Preventing the Spread of Vancomycin-Resistant Enterococci (VRE) in Canada* (1997) (10)
- *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases* (1997). Produced by the Office of Special Health Initiatives (11)
- *Preventing Infections Associated with Foot Care by Health Care Providers* (1997) (10)
- *Preventing Infections Associated with Indwelling Intravascular Access Devices* (1997) (10)
- *Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings* (1996) (12)
- *A National Consensus on Guidelines for Establishment of a Post-Exposure Notification Protocol for Emergency Responders* (1995) (13)
- *Laboratory Biosafety Guidelines*. 2nd ed. (1996) Produced by the Office of Biosafety (14)
- *Infection Control Guidelines for Long Term Care Facilities* (1994) (15)
- *Antimicrobial Utilization in Health Care Facilities* (1990) (16)
- *Infection Control Guidelines II: Prevention of Surgical Wound Infections* (1990) (17)
- *Infection Control Guidelines III: Prevention of Nosocomial Pneumonia* (1990) (Under revision) (18)
- *Infection Control Guidelines IV: Prevention of Urinary Tract Infections* (1990) (19)
- *Infection Control Guidelines for Organization of Infection Control Programs in Health Care Facilities* (1990) (20).

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2 For an ongoing update of the Infection Control Guideline series, please view the Health Canada Web site at http://www.hc-sc.gc.ca/hbp/lcdc/dpg_e.html#infection.

For information regarding the above Health Canada publications, contact:

Division of Nosocomial and Occupational Infections
Bureau of Infectious Diseases
Laboratory Centre for Disease Control
Health Canada, PL 0603E1
Ottawa, Ontario K1A 0L2
Telephone: (613) 952-9875
Fax: (613) 998-6413
Email:
Web site at http://www.hc-sc.gc.ca/hbp/lcdc/dpg_e.html#infection

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Subcommittee for Infection Control Guidelines on Occupational Health in Health Care

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Adenovirus
Calicivirus
Campylobacter
Clostridium difficile
Cryptosporidium
Entamoeba histolitica
***Escherichia coli* - verotoxigenic**
Giardiasis
Norwalk Virus
Rotavirus
***Salmonella* (non-typhi)**
Shigella
***S*mall round enteric viruses**
Undiagnosed diarrheal illnesses

Respiratory Infections include:
Adenovirus
Mycoplasma
Parainfluenza
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Infection Control Guidelines for Occupational Health in Health Care

Preamble

The purpose of an Occupational Health program is to promote the health and well-being of employees and patients, to provide a safe and healthy workplace and health care environment, to prevent or decrease illness due to workplace hazards, including biohazards and to adhere to legislation.

In recent years, the delivery of health care services has undergone substantial change. Regionalization of health care delivery, increasing rates of day surgery, increases in the acuity level of admitted patients, an aging work force, transition of care from hospitals to the community, employees who work part time in more than one institution, and students from a variety of teaching institutions, have become the norm. These influence how the health care setting in general, and the occupational health program specifically delivers programs.

Occupational infections may occur in the delivery of health care and are acquired by health care workers from various sources in their workplace, e.g. an infected individual or contaminated equipment/environment. For the purpose of this document the term *health care worker* (HCW) will be used to include any individual who may have the potential to acquire or transmit infectious agents during the course of his/her work in health care and includes students, e.g. nurses, residents, doctors and researchers. Volunteers and emergency responders who have direct patient contact should be considered as HCWs and in particular, included in the process for post-exposure management. The term *patient* will include any individual who receives health care irrespective of the type of setting/service. Nosocomial infections, acquired by patients as a result of receiving health care, are outside the jurisdiction of this document and are not discussed.

This document is designed to assist individuals, especially occupational health practitioners and medical directors, and infection control practitioners who are responsible for infection control issues that affect HCWs. Although not intended to specifically address home care and community health workers, contract services, day care or correctional service workers, the information may be useful in those settings. It remains the responsibility of each workplace administration to ensure that an Occupational Health program is in place that is applicable to the specific health care setting, including appropriate policies and procedures. The Occupational Health (OH) staff of each health care workplace must ensure that workers employed by others but working within its jurisdiction, such as contractors or those from other education facilities, meet the Occupational Health requirements of their workplace. Each workplace administration must also ensure access to appropriate medical resources for the OH program through either an internal or external referral process.

The format of this revision of *Occupational Health in Health Care Facilities (1990)* has been changed to reflect the principles of Occupational Health programs as outlined by four components: *risk assessment, risk control measures, education* and *evaluation*. A template (see Table I on page ___) is used in Sections A & B to assist the reader in addressing all aspects of these components.

Section A – the foundation of an effective Occupational Health program is prevention based on sound risk assessment. Section A includes general risk assessment and recommendations that should be implemented by all employers in order to prevent/minimize occupational exposures to infectious diseases.

Section B - it is inevitable that there will be occasions when a HCW is either infected with or exposed to an infectious disease. Section B is intended to augment the general prevention recommendations of Section A with risk assessment and prevention and management recommendations specific to the particular disease. Variables related to risk (e.g. circumstances of exposure, use of Personal Protective Equipment, likelihood of transmission) must be considered in determining the appropriate management. Section B should never be used in the absence of implementing Section A.

Section C – this summarizes the Canadian recommendations for immunization and augments the Administrative Control recommendations in Section A-2.1.3.6.

Section D – this is a summary table of the diseases in Section B outlining exposure definitions and the need for prophylaxis, treatment and/or work restrictions. It is intended as a guide to the more detailed information in the text of Section B.

Sections A and B contain recommendations for action and frequently start with the wording, "OH should …".

The document focuses on infectious diseases for which there is evidence that person-to-person transmission has occurred in the context of occupational exposure. Most infectious diseases are addressed individually, however some will appear as:

- *Grouped Diseases/Infections*– certain types of infections have similar information and management approaches. Since so much information is similar, they are considered under the categories of Hepatitis A Virus/Hepatitis E Virus, Gastroenteric Infections, Respiratory Infections and Bloodborne Pathogens. Where disease-specific evidence or recommendations are necessary within the category, these will be stated.

- *Referred Diseases* – where Health Canada Guidelines are already published, the reader is referred to these documents for detailed information beyond the scope of this document. These include Creutzfeldt-Jacob disease, Tuberculosis, Viral Hemorrhagic Fevers and Bloodborne Pathogens. The companion documents that should be available for use in conjunction with this document are listed in Section A on page _____.

- *Zoonotic Diseases* – most do not require OH management. Rabies and Malaria appear in the tables only and are referred to Public Health.

Other infectious diseases have not been addressed for the following reasons:

- *No person-to-person transmission in Canada has been documented* - several infectious diseases, (e.g. aspergillosis, legionella, toxoplasmosis, hantavirus, arboviruses) which

although diagnosed in patients in Canadian health care facilities demonstrate no evidence of person-to-person transmission and are not considered to be a risk for acquisition in the health care setting.

- *There is no evidence of person-to-person transmission in the context of occupational health* - infectious diseases, e.g. *Helicobacter pylori*, human papillomavirus and candida while transmissible from person-to-person have not been shown to be transmitted to/from HCWs.

- *There is insufficient information and developing areas* - a variety of infectious agents, e.g. tropical diseases, molds, xeno-zoonoses, gene therapy may occasionally be encountered in the occupational health context. The risk of transmission to HCWs is not yet known. As new information becomes available regarding these risks, existing guidelines will need to be modified. However, information at present is not definitive and specific recommendations cannot be made.

- *They are uncommon* - many infectious diseases are uncommon to Canadian health care delivery and other literature should be consulted.

This document recognizes that collaboration is essential and encourages OH to coordinate its activities with key partners from administration, infection control, laboratories, educational services, environmental services, maintenance, purchasing and product evaluation, health and safety committees and public health to achieve its infection control objectives.

In this document, *Infection Control Guidelines for Occupational Health in Health Care*, there is frequent reference to the companion document *Infection Control Guidelines: Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care* (1). That document provides a comprehensive list of infectious diseases and the precautions necessary to prevent transmission when caring for patients. Determining compliance with the Routine Practices and Additional Precautions recommended in *Risk Control Measures to Prevent HCW Exposure to or Infection with Disease* (Section A-2.1.3, Section B-2.1.4) is essential in determining whether a true exposure has occurred and if follow-up is required as outlined in *Risk Control Measures to Manage HCWs Exposed to or Infected with Disease* (Section B-2.2.)

Recommendations regarding HCWs who are symptomatic, colonized or infected with a communicable disease, independent of an occupational exposure, are discussed in *Risk Control Measures to Manage HCWs Exposed to or Infected with Disease* (Section B-2.2). Recommendations for prophylaxis and treatment were current at the time of publication. It may, however, be prudent to confer with local public health policy to ensure consistency. Due to the rapid changes regarding drug regimens, specific recommendations have not been made and the reader is referred to current texts, e.g. the Red Book (21)or Control of Communicable Diseases Manual (22).

Recommendations for immunizations are those of Canada's National Advisory Committee on Immunization (NACI) (5) unless there is evidence to support an identified alternative.

Criteria to Confirm the Diagnosis of the Disease (Section B-2.2.3) have been included with each disease to help the reader identify a true exposure/infection and to clarify management.

Finally, an algorithm (see Table II on page ___) has been developed to assist the reader to clarify the roles and responsibilities of OH, administration and the HCW, and to outline the path for management of infection related issues involving the HCW.

Objectives

The infection control objectives of an Occupational Health program should be consistent with the general program for infection control. They should include:

1. *Risk Assessment*: evaluate the workplace to identify hazards related to occupation and to assess and analyze the occupational risk associated with exposure to potentially harmful infectious diseases, taking into consideration events, circumstances and practices.

2. *Risk Control Measures:* Implement appropriate occupational health policies, procedures and programs to prevent and/or manage exposures or infections in HCWs including outbreak management.

    - Establish mechanisms to ensure appropriate and timely communication with allied professionals.

    - Demonstrate fiscal responsibility through policies, procedures and programs that prevent or reduce occupational infections, absenteeism and disability.

3. *Education*: provide educational programs for HCWs regarding the importance of sound personal hygiene habits and compliance with recommended infection control precautions as an individual's responsibility in the delivery of care and prevention of transmission of infections.

4. *Evaluation*: implement ongoing, systematic evaluation to ensure that policies, procedures and programs are consistent with current recommendations, achieve their stated objectives and are in compliance with current regulations.

Table I: OH Infectious Disease Management Template

1.	**Risk Assessment for Transmission of Disease to HCWs**
1.1.	Clinical Significance of Disease
1.2	Evidence of Exposure/Transmission of Disease
1.3	Evidence of Occupational Transmission of Disease
2.	**Risk Control Measures**
2.1	Risk Control Measures to Prevent HCW Exposure to or Infection with Disease
2.1.1	Engineering Controls to Prevent HCW Exposure to or Infection with Disease
2.1.2	Administrative Controls to Prevent HCW Exposure to or Infection with Disease
2.1.3	OH Work Practices to Prevent HCW Exposure to or Infection with Disease
2.1.4	Personal Protective Equipment to Prevent HCW Exposure to or Infection with Disease
2.2	**Risk Control Measures to Manage HCWs Exposed to or Infected with Disease**
2.2.1	Assessment of HCW Exposure to Disease
2.2.1.1	Method of Transmission of Disease
2.2.1.2	Definition of Occupational Exposure to Disease
2.2.2	Assessment of Source of HCW Exposure
2.2.2.1	Communicability of Source
2.2.3	Criteria to Confirm the Diagnosis of Disease
2.2.4	OH Work Practices to Manage HCWs Exposed to or Infected with Disease
2.2.4.1	HCW Exposed to Disease
2.2.4.2	HCW Colonized, Symptomatic, or Infected with Disease
2.2.4.3	OH Management of Disease Outbreak
2.2.4.4	OH Reporting to Public Health of HCW with Disease
3.	**Education to HCWs about Prevention and Management of Exposure to or Infection with Disease**
4.	**Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Disease**

Table II

OH Infectious Disease Management Strategy

Section A: Recommendations for Infection Prevention and Control Components of an Occupational Health Program

1. Risk Assessment to Prevent Transmission of Disease to Health Care Workers (HCWs)

The Occupational Health (OH) program focuses on prevention, health promotion, and the recognition, evaluation, and control/reduction of health hazards in the health care setting. In order to accomplish this, one of the primary activities of OH staff is to perform risk assessments. Critical to such assessments is knowledge of three factors: the potential consequence of the hazard, the likelihood of exposure to the hazard and the number of persons regularly exposed to the hazard (23). Infection disease risk assessment requires adequate knowledge of the following:

- clinical manifestations and significance of infectious agent,
- epidemiology – characteristics, reservoir, mode of transmission, incubation period, period of communicability,
- transmission factors – type of exposure, size of innoculum, infectivity of organism, susceptibility, control methods.

Workplace surveillance, which is the systematic collection, analysis and dissemination of information on disease, injury or hazard for the prevention of morbidity or mortality (24) provides much of the necessary information for risk assessment. Walk-through visits to methodically examine the worksite, are an important part of data collection, and assist the OH nurse to recognize and understand working conditions of staff including supplies, equipment, standards of practice, and training. Whenever appropriate, the infection control practitioner or safety officer should participate in these work site visits. The goal should be to visit all areas of the health care setting on at least an annual basis and to visit high risk sites more frequently. Additional visits should be conducted by nurses to increase their visibility and maintain an ongoing knowledge of the workplace. Workplace surveillance provides valuable information about infectious disease hazards in order to consider the various levels of risk, to identify the employee populations to be monitored, to establish priorities, and to reinforce two-way communication between OH and HCWs.

OH also provides risk assessment specific to the HCW by way of a health assessment. This involves obtaining the OH history, testing of the HCW, interpreting data, monitoring and educating. The preplacement exam of the HCW, i.e. done after hiring, before placement, is an ideal time to begin the risk assessment. Various workplaces have different approaches. Some complete an entire physical examination with extensive laboratory tests while others find a more targeted approach with a questionnaire and selective laboratory testing to be satisfactory and more cost effective. Information about conditions that may effect skin integrity, latex allergy, and past immunizations is important to HCW placement. Specific aspects of the preplacement exam are identified throughout this guideline in relation to the particular disease. In addition, ongoing interactions between OH and the HCW, e.g. exposures, infections, scheduled recall visits may contribute information to the overall risk assessment process.

Data collected from all sources regarding workplace surveillance, HCW preplacement exams and periodic interactions with HCWs enable OH to assess the levels of risk for the various infectious

disease hazards in the workplace. With all aspects considered OH is able to make an estimation of risk that can guide decisions about risk management strategies (23,25).

Please refer to Appendix II for further information on assessing the level of risk.

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

1.1 OH should recognize risk situations with the potential for occupational exposure/transmission of infectious disease either to or from the HCW and other individuals or the environment through the following activities that include but are not limited to:

1.1.1 regular workplace surveys/walk-through visits to be familiar with the workplace, to collect information regarding potential for exposure to infectious disease hazards, and to identify work practices (23,25,26),

AIII

1.1.2 preplacement and periodic exam for immune status, achieving immunization requirements, communicating the benefits and side effects of each vaccine to the worker, tuberculin skin testing, recording history of previous infectious diseases and appropriate serology (5,26-28),

AII

1.1.3 review of occupational infectious disease exposure records, including needle stick or sharps injuries and actual occupational transmission of infectious diseases in the health care setting (26-29),

AII

1.1.4 review of infectious disease literature for evidence regarding exposure/transmission/prevention/control (26,27,30),

AIII

1.1.5 establish and maintain communication with appropriate personnel, departments and or agencies in order to meet OH objectives (23,25-27).

AIII

1.2 OH should collect information and consider various occupational risks according to the potential consequence of exposure and transmission of the infectious disease, the likelihood of exposure to the infectious agent, and the number of persons exposed regularly to the hazard (23,28).

AIII

1.3 OH should establish specific objectives to prevent and manage differing occupational risks for infectious diseases on an ongoing basis (26-28).

AIII

1.4 OH should recommend to administration appropriate action(s) to meet the program's objectives that may include (26-28) but are not limited to:

1.4.1 developing new or revised control measures (see 2. below),
1.4.2 providing education (see 3. below),
1.4.3 developing, reviewing or revising quality assurance methods for evaluation (see 4. below).

AIII

1.5 OH should act as an advocate for safe, healthy workplaces by raising awareness to senior management of their responsibility for minimizing the risk of infectious disease exposure/transmission in the workplace (26-28).

AIII

1.6 OH should use quality assurance principles to ensure effectiveness in identifying risks (26-28).

AIII

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Disease

The risk control measures described in this guideline utilize the industrial hygiene hierarchy (23-25,28) of:

1) **Engineering Controls,**
2) **Administrative Controls,**
3) **OH Workplace Practices and**
4) **Personal Protective Equipment.**

The control measures are listed in descending order according to their effectiveness in reducing the risk of exposure to infectious diseases. For example, Engineering Controls decrease or eliminate the hazard whereas the use of Personal Protective Equipment only provides a barrier between the HCW and the hazard. Similarly, an Engineering Control would be more effective because the HCW is not responsible for decision-making regarding the intervention at the time of interaction with the patient when it may be difficult to switch to an alternative action such as Personal Protective Equipment (25-28).

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Disease

Engineering Controls (28) decrease the HCWs exposure to the hazard by reducing the hazard at the source (25-28), e.g. negative ventilation pressure with exhaust to the outside in a room for a person with tuberculosis (12); design modifications for sharp instruments making them safer and

less likely to pierce the skin of the HCWs and potentially exposing HCWs to bloodborne pathogens (31-36).

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

2.1.1.1 Administration and OH should ensure effective equipment, preferably proven to reduce exposure and improve safety during intended use, during HCW handling, for maintenance and during cleaning such as the following:

a) Adequate number of appropriately maintained negative pressure rooms located in areas of the health care setting where patients requiring Airborne Precautions are most likely to be placed (1,12),

AIII

b) Adequate number of optimally placed hand washing sinks, dispensers for soap and or waterless antiseptic hand rinses and single-use hand towels to optimize hand hygiene (9),

AIII

c) Knee or foot controlled sinks rather than sinks with hand controls to prevent cross-contamination (9),

BII

d) Adequate number of appropriately maintained accessible eye wash stations for use in areas where eye splashes are most likely to occur (7,9),

AIII

e) Adequate number of optimally placed and appropriate, puncture - proof sharpsdisposal and other biohazard containers(7,37),

AIII

f) Convenient and safe equipment for cleaning and sanitizing patient care articles, e.g. bedpans, urinals and measuring containers to prevent HCW exposure to potentially infectious body fluids (9),

AIII

g) Adequate number of appropriately maintained refrigerators to ensure separate and safe storage of food, medications and vaccines and laboratory specimens [ ].

AIII

h) Adequate equipment for patient procedures, e.g. retractable needles (7), blunt needles (38), needleless intravenous systems (39), (37), (9), endoscopes (9).

AIII

i) Heating, ventilation and air conditioning (HVAC) systems with appropriate design and construction that can be appropriately maintained and cleaned. (CSA draft revision to be sent to us shortly.).

AIII

j) A waste management system with appropriate design and function. (9,37,40,41).

AIII

2.1.1.2 Administration should ensure processes are in place for:

a) appropriate cleaning and maintenance of heating, ventilation and air conditioning (HVAC) systems. (to be in CSA revision?),

AIII

b) A safe potable water supply and alternatives during disruptions [ ],

AIII

c) compliance with discipline-specific safety standards with respect to the use of equipment that enhances safety, e.g. sharps containers (37)[ ], biosafety cabinets (7,14), heating, ventilation and air conditioning systems [csa], refrigeration [ ],

AIII

d) appropriate processes are in place for housekeeping, e.g. cleaning, disinfection and sterilization of patient care equipment(9,42-46).

AIII

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Disease

Administrative controls include the development and adoption of policies and procedures that support Engineering Controls, e.g. negative pressure rooms to accommodate suspected or confirmed respiratory TB cases (23,25-27), the use of Work Practices, e.g. immunization of HCWs (5,26,27), and Personal Protective Equipment for HCWs (23,25-27), e.g. gloves if exposure to body fluids is anticipated.

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

2.1.2.1 Administration should ensure there is an effective OH program with clearly defined objectives (26-28).

AIII

2.1.2.2 Administration should provide adequate financial and human resources to meet the OH program objectives and, whenever possible, evaluate:

a) Adequate OH professional and clerical staffing (27,47),

AIII

b) Access to expert consultative services when required,

AIII

c) Adequate support staffing, e.g. housekeeping to comply with OH and Infection Control policies and procedures (48),

AIII

d) Access to reference material that includes, but is not limited to, web based resources and publications as listed on page 3 of this guideline as well as the following publications:

Red Book, American Academy of Pediatrics, 1997 (21),

Control of Communicable Diseases Manual, 17th Edition,Chin J., 2000 (22).

AIII

2.1.2.3 Administration and OH should ensure the OH program has relevant policies and procedures which adhere to legislative requirements, published guidelines and literature and may include but are not limited to:

a) Surveillance including data collection, analysis and communication of results (49),

AIII

b) Preplacement and periodic HCW screening regarding:

- Vaccine preventable diseases for all HCWs according to recognized guidelines and published literature (4-6,8,13),

- Provision of appropriate vaccines unless contraindicated (4-6,8,13),

- Documentation of and reasons for refusal of vaccine, if this occurs (5,26-28),

- Tuberculosis testing according to recognized guidelines and published literature (12),

- Storage of data on the immunization status of HCWs in a database where it is readily accessible, especially in an outbreak situation (50),

AIII

-Appropriate placement of HCW including considerations for the immunocompromised HCW fitness for work prior to placement (26-28),

AIII

c) Management of HCWs with specific health conditions with increased risk for exposure to infections, e.g. dermatitis and those who are immunocompromised (7,28),

AIII

d) Identification of objectives to reduce needlestick injuries including establishment of a multidisciplinary committee (31-33,51) to support objectives,

BIII

e) Purchase and testing of equipment (also see Engineering Controls page __) (51,52)masks, gloves,

AIII

f) Safe work procedures (1,7,23,25,34,35,53-56),

AIII

g) Management of HCW exposed to, colonized or infected with microorganisms to include (26-28):

i) ensuring a referral process, either internal or external, for confirmation of diagnosis and clinical management which may include:

- Laboratory investigation
- Prophylaxis
- Treatment
- Counselling
- Follow-up

ii) ensuring a process for post-exposure management that may include:

- Referral for clinical management
- Work restrictions/Reassignment/Return to work
- Outbreak management
- Reporting to Public Health

iii) ensuring the provincial workers compensation group process for occupational exposure and or infection,

AIII

h) Outbreak management (57),

AIII

i) Communication with appropriate personnel and or agencies (33)?(23,25-28):

- Administration
- Educational Services
- Emergency Responders
- Environmental Services
- Infection Control
- Laboratories
- Maintenance
- Product Evaluation
- Public Health
- Purchasing/Materials Management
- Quality Assurance
- Safety

AIII

j) Confidentiality and maintenance of HCW medical record through the use of a secure record keeping system as required by legislation.

k) Education of HCW and OH staff (26-28).

AIII

2.1.2.4 Administration should ensure the OH program has supporting systems in place to prevent or minimize occupational exposure through compliance with policies and procedures, safety standards and regulations including provincial workers compensation group. Supporting systems include but are not limited to:

a) Adequate housekeeping and waste management services to maintain a safe work environment (9),

AIII

b) Appropriate processes for cleaning, disinfection and sterilization of patient care equipment (9),

AIII

c) Process for purchasing equipment and supplies proven to have a safer design to prevent HCW exposure during handling, maintenance or cleaning, e.g. passive needlestick devices (32), needleless intravenous systems (7), hands free sinks (9), sharps containers (34,58),

AIII

d) Process for purchasing the most appropriate Personal Protective Equipment as recommended to prevent HCW exposure to infectious disease (1,7,23,25-28,59).

AIII

2.1.2.5 Administration should ensure external service providers comply with the workplace OH program and that this is outlined in contractual agreements (26,27).

BIII

2.1.2.6 Administration should ensure the OH program has access to appropriate medical and

laboratory resources for timely diagnosis, laboratory investigation, prophylaxis, treatment and follow-up as required [ ].

AIII

2.1.2.7 Administration should support the educational component of the program by ensuring (26-28):

a) HCW education,

b) OH staff education, i.e. maintaining competencies.

AIII

2.1.2.8 Administration and OH should ensure compliance with OH policies and procedures, safety standards, provincial workers compensation group regulations, Workplace Hazardous Materials Information System (WHMIS), and other OH legislation.

AIII

2.1.2.9 Administration should ensure adequate supervision of all HCWs to ensure compliance with Infection Control policies, procedures and practices (27,36,57).

AIII

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Disease

Work practices include those actions intended to decrease the risk of HCW exposure to infectious diseases (23,25-28).

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

2.1.3.1 OH should identify and assess the risk of employee exposure to infectious diseases (26-28,57).

AIII

2.1.3.2 OH should develop OH program objectives (26-28).

AIII

2.1.3.3 OH should identify and secure financial and human resources to meet the stated objectives (26-28).

AIII

2.1.3.4 OH should develop policies and procedures to direct the OH program objectives (26-28).

AIII

2.1.3.5 OH should advise HCWs to practice good infection control as recommended in Health Canada's Guidelines: *Routine Practices and Additional Precautions for Preventing the*

Transmission of Infection in Health Care (1).

AIII

2.1.3.6 OH should implement programs and procedures to decrease the risk of exposure to or colonization/infection with infectious diseases including but not limited to:

a) Assessing workplace regularly for hazardous situations which allow for exposure and or transmission of infection (26-28),

AIII

b) Conducting surveillance including data collection, analysis and communication of results (26-28),

AIII

c) Conducting preplacement and periodic screening for vaccine preventable diseases for all HCWs (5,26-28),

AIII

d) Providing appropriate vaccines as outlined in Section B unless contraindicated (5,8) (4,6,13),

AII

e) Ensuring appropriate handling and delivery of immunizations, immunoglobulins, and medications (5),

AIII

f) Documenting immunization administration or refusal of vaccine according to standards of practice (26-28),

g) Managing HCWs with dermatitis and those who are immunocompromised (26-28),

AIII

h) Managing HCWs exposed to, colonized or infected with microorganisms to include (57):

i) ensuring a referral process either internal or external, for confirmation of diagnosis and clinical management that may include:
- Laboratory investigation
- Prophylaxis
- Treatment
- Counselling
- Follow-up

ii) ensuring a system for post-exposure management that may include:
- Referral for clinical management

- Work restrictions/Reassignment/Return to work
- Outbreak management
- Reporting to Public Health

iii) ensuring the provincial workers compensation group process for occupational exposures and or infections,

AIII

i) Ensuring OH participation in the workplace outbreak management plan (57),

AIII

j) Ensuring appropriate handling and disposal of sharps by HCWs (7,31-36),

AIII

k) Identifying, piloting and using equipment that has been designed and proven to reduce exposure and improve safety as listed in Engineering Controls page __ (31,32,51).

AIII

2.1.3.7 OH should establish and maintain communication with appropriate personnel, departments and agencies in order to meet OH program objectives (26-28):

- Administration
- Educational Services
- Emergency Responders
- Environmental Services
- Infection Control
- Laboratories
- Maintenance
- Public Health
- Purchasing/Materials Management
- Safety

AIII

2.1.3.8 OH should provide expertise to joint Occupational Health and Safety committee, Infection Prevention and Control committee, other related committees and Administration (26-28).

AIII

2.1.3.9 OH should report work infection risk assessment reviews to the joint Occupational Health and Safety committee, Infection Prevention and Control committee and Administration (23,25-28).

AIII

2.1.3.10 OH must maintain confidentiality of HCW medical records as per legislation.

2.1.4 Personal Protective Equipment to Prevent HCW Exposures to or Infection with Disease

Personal Protective Equipment includes clothing, gloves, masks and eyewear which can be used by a HCW to provide a barrier from potentially infectious microorganisms (25-27). Although Personal Protective Equipment reduces the risk of exposure to an infectious agent, it may not be 100% effective (60).

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

2.1.4.1 OH should monitor, evaluate and recommend products for Personal Protective Equipment as recommended in Health Canada guidelines *Routine Practices and Additional Precautions* (1,7,12)?.

AIII

2.1.4.2 Administration should provide Personal Protective Equipment that has been proven to have a safer design to prevent exposure to infectious diseases (1,7,12,23,25-28,31,32,49,61,62).

AIII

2.1.4.3 Administration should provide gloves which are appropriate for a variety of tasks and which may include non-powdered, low protein latex gloves (1,7,63,64) vinyl or alternative synthetics, e.g. nitrile, for managing HCW with latex allergy.

AIII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Disease

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

2.2.1 Assessment of HCW Exposure to or Infection with Disease

2.2.1.1 OH should assess each incident (7,13) with the disease specific exposure definition to determine if the circumstances constitute an exposure (22) using other factors such as, but not limited to:

- the method of transmission,
- type of exposure,
- use of Personal Protective Equipment,
- compliance with Routine Practices and or Additional Precautions,
- infectivity of source and
- immunity of exposed.

AII

2.2.2 Assessment of Source of Health Care Worker Exposure to Disease

2.2.2.1 OH should confirm the diagnosis and communicability of the source using other factors to confirm the diagnosis such as (22), but not limited to:

- incubation period,
- period of communicability,
- laboratory results and
- liaison with Infection Control, medical staff and or Public Health

AIII

2.2.3 Criteria to Confirm the Diagnosis of the Disease

2.2.3.1 OH should confirm that the source of the HCW exposure had an infection compatible with the criteria for diagnosis.

AIII

2.2.3.2 OH should assess the clinical presentation of the symptomatic HCW against the disease specific criteria for diagnosis.

AIII

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Disease

2.2.4.1 OH should implement the procedures for the management of HCWs exposed to or infected with infectious diseases according to the disease specific *Definition of Occupational Exposure* and or *Criteria to Confirm the Diagnosis* in this manual. Such procedures may be performed by OH or arranged through an external referral. Work Practices may include (5,6,8,26-28) but are not limited to:

a) determining immune status of HCW,
b) managing exposure/infection including:
   - laboratory investigations,
   - prophylaxis,
   - treatment,
   - counseling,
   - follow up,
   - work restrictions/reassignment/return to work,
c) performing contact tracing,
d) managing outbreak situations,
e) assessing fitness for work,
f) liaising with IC,
g) liaising with Public Health,
h) liaising with Emergency Responders,
i) reporting to Public Health

- infectious diseases that require statutory reporting and may require contact tracing and prophylaxis of close contacts.

AIII

3. Education to HCWs about Prevention and Management of Exposure to and Infection with Disease

Education of HCWs is an essential component of an OH program. OH staff need to be creative with focused education to meet the needs of different groups (26-28,65,66,66). A Canadian study conducted in 1996 reported that less than 50% of survey respondents were confident of their knowledge of protective precautions and their knowledge of bloodborne diseases and 20% of survey respondents did not know what to do if they had a sharps injury (26-28,67).

Education about infectious disease hazards is needed to increase understanding and to encourage prompt reporting, evaluation, and treatment (57,68,69), reese and betts] of injuries. Prompt reporting to the provincial workers compensation group is required.

Important topics to address include the use of Routine Practices for infection control (1) that incorporate practices formerly known as bloodborne pathogen precautions or universal precautions, including hand hygiene (68). Additional precautions to prevent and control airborne, contact, and droplet infections are included.

Education programs should be innovative, comprehensive, should explain consequences of non-compliance clearly and should offer the latest exposure and infection evidence to support the practice (7).

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

3.1 OH in conjunction with Infection Control and Educational Services should provide orientation and ongoing education as well as hands on training, if required, to HCWs to prevent and control infectious disease exposure and transmission of infection that will include but is not limited to:

3.1.1 Role of OH and importance of liaison with Infection Control and Public Health,

AIII

3.1.2 Immunizations recommended for HCWs (5),

AII

3.1.3 Disease epidemiology:

- methods of transmission,
- incubation period,
- period of communicability,

- risk of transmission,
- signs/symptoms of infection,

AIII

3.1.4 Exposure prevention:

- exposure definitions,
- importance of Routine Practices including personal hygiene and hand hygiene and Additional Precautions (Airborne, Droplet and Contact) (1) and complying with the use of Personal Protective Equipment,
- importance of complying with safe work practices (26-28,32,35), including garbage disposal,(66)
- importance of not eating, drinking, applying cosmetics or smoking in areas where patient care takes place or in a laboratory setting, (26-28,70,71) (66)or where contaminated equipment is processed.

AIII

3.1.5 Post exposure follow-up (22,57):

- first aid procedures (7,8,8,13),
- screening,
- prophylaxis and treatment,
- referral for clinical management,
- work restrictions/reassignment/return to work (26-28,66),
- contact tracing,
- outbreak control measures,

AIII

3.1.6 Reporting:

3.1.6.1 Reporting to OH:

- occurrence of infectious disease exposures and infections (72),
- initial and recurrence of symptoms in self or family members,
- when advised; prior to return to work,

3.1.6.2 Reporting to Public Health:

- case and suspected/confirmed outbreak reporting as required by the Provincial Public Health Act,
- regarding inclusion of Emergency Responders for rapid notification for contact tracing as in *A National Consensus on Guidelines for Establishment of a Post-Exposure Notification Protocol for Emergency Responders* (13,73-75),

3.1.6.3 Reporting to provincial workers compensation group:

- information required about occupational exposures or infections (76).

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Disease

"Effective surveillance systems for monitoring existing practices and methods for gathering information about occupational risk are essential for achieving a safer healthcare workplace (77). The use of the risk assessment process, risk control measures, and education should increase the ability of OH staff to reduce exposures of HCWs, to provide appropriate treatment and follow-up of infections to prevent transmission and to establish priorities for resource allocation. Evaluation processes to monitor/measure outcomes in all components are necessary to ensure the efficacy and cost effectiveness of the OH program (26-28,66).

Recommendations

It is the responsibility of senior management to provide sufficient resources to Occupational Health programs to achieve the following recommendations.

4.1 OH should evaluate the efficacy and cost-effectiveness of the individual components of the OH program. This can be achieved through analysis of outcome indicators. Indicators should include but are not limited to:

4.1.1 Numbers or rates for occupational versus community exposures or infections

4.1.2. Rates for exposures and infections, e.g. bloodborne, TB.

4.1.3 Immunization and vaccine refusal rates.

4.1.4 Time loss due to exposures and infections.

4.1.5 Workplace exposure/infection hazards.

4.1.6 Equipment failures that have a potential to result in exposures.

4.1.7 Educational sessions/programs participation.

4.1.8 Staff surveys of infection knowledge, prevention and control knowledge and practice, e.g. hand hygiene surveys.

4.1.9 Referral services.

4.1.10 Public Health liaison,

4.1.11 Cases of vaccine preventable diseases.

4.1.12 Trends in incidence/prevalence rates.

AIII

4.2 OH should liaise with Infection Control to conduct assessments of HCW compliance with Routine Practices and Additional Precautions (1).

BIII

Section B: Recommendations for Diseases of Significance to Occupational Health

Part I Individual Diseases

ADENOVIRUS - Epidemic Keratoconjunctivitis (EKC)

The following information pertains to adenovirus strains that cause epidemic keratoconjunctivitis (EKC); see page __ for information about adenoviruses causing respiratory infections.

1. Risk Assessment for Transmission of EKC to HCWs

1.1 Clinical Significance of EKC

EKC is a severe and painful conjunctivitis that may continue for several weeks and is followed by a phase of corneal infiltration, often impairing vision for months (78).

1.2 Evidence of Exposure/Transmission of EKC

Since World War II, nosocomial epidemics have been attributed to eye-hand-eye contact with the patient's eye with the unwashed hands of HCWs, inadequately disinfected ocular instruments, and contaminated ophthalmic solutions (78).

1.3 Evidence of Occupational Transmission of EKC

Outbreaks involving transmission through hand-eye contact have been frequently reported (78-82).

Jernigan et al reported on an outbreak involving 126 (7%) of 1870 patients and 4 ophthalmologists and concluded transmission was due to inadequate disinfection of instruments, especially pneumotonometers, and finger-to-eye transmission by HCWs. Ophthalmologists with EKC were a significant risk factor for patients acquiring infection (78).

One ophthalmology clinic reported 15 HCWs acquired EKC during an outbreak (10 ophthalmologists, 3 nurses, and 2 support staff). Five of the 15 experienced secondary spread to their household contacts (79).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I - IV is required in addition to the following specific recommendations for adenovirus causing EKC.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with EKC

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with EKC

OH should ensure optimal placement of appropriately maintained eyewash stations.

AIII

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with EKC

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with EKC

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment to Prevent HCWs Exposure to or Infection with EKC

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a patient on Contact Precautions for suspected or confirmed EKC and to wear a gown if contact with the patient or environmental surfaces is likely (1).

AIII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with EKC

OH should instruct HCW to flush/irrigate eye(s) with water as soon as possible as a First Aid measure if eye contamination occurs.

AIII

2.2.1 Assessment of HCW Exposure to EKC

2.2.1.1 Method of Transmission of EKC

EKC is transmitted by direct contact of ocular mucous membranes with infectious eye secretions via contaminated hands or indirectly through contaminated equipment or solutions.

2.2.1.2 Definition of Occupational Exposure to EKC

OH should define HCW exposure as direct or indirect contact of ocular mucous membrane with infectious eye secretions.

AIII

2.2.2 Assessment of Source of HCW Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period of EKC is 5 –12 days, duration may be exceeded in many instances. The period of communicability continues from late in the incubation period to as long as 14 days after onset; prolonged viral shedding has been reported (22).

2.2.3 Criteria to Confirm the Diagnosis of EKC

Clinical illness – conjunctivitis.

Plus laboratory evidence – viral culture of eye positive for adenovirus.

Or clinical illness in a HCW who is epidemiologically linked to a case.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with EKC

2.2.4.1 HCW Exposed to EKC

There are no modifications of work practices or work restrictions for HCWs exposed to EKC.

2.2.4.2 HCW Symptomatic or Infected with EKC

OH should refer HCWs symptomatic/infected with EKC for confirmation of diagnosis and clinical management that may include laboratory investigation.

AIII

OH should inform Infection Control of a suspected or confirmed case as soon as possible.

AIII

OH should exclude HCWs infected with EKC from direct patient contact until 14 days after the onset of clinical infection in the second eye, (if second eye infected) as this represents the period of greatest communicability.(78,79,83)

AII

OH should refer HCWs infected with EKC for clinical reevaluation prior to return to work.

AIII

2.2.4.3 OH Management of EKC Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control if an outbreak is suspected.

AIII

OH may modify work restrictions as necessary in outbreak situations.

BIII

2.2.4.4 OH Reporting to Public Health of HCW with EKC

There is no reporting requirement for a single case; OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with EKC

OH should design education specific to EKC according to recommendations outlined in Section A – III and about

- appropriate handling, i.e. cleaning disinfecting and sterilization of equipment,
- informing OH if conjunctivitis occurs (48),
- disposal of contact lenses and eye make-up
- instructing HCW to irrigate eye(s) as soon as possible in the event of an exposure.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with EKC

OH should refer to Section A – IV to develop an evaluation program specific to EKC including;

number of OH exposures,
number of OH exposures leading to transmission.

AIII

CREUTZFELDT-JACOB DISEASE (CJD)

Administration should ensure OH develops policies and procedures for the prevention and management of HCW exposure and or infection with CJD according to Health Canada's *Infection Control Guidelines for Creutzfeldt-Jakob Disease (CJD) in Canada* (2), and related Provincial recommendations.

CYTOMEGALOVIRUS (CMV)

Risk Assessment for Transmission of CMV to HCWs

1.1 Clinical Significance of CMV Infection

The most severe form of CMV, with signs and symptoms of severe generalized infection, especially involving the central nervous system and liver, develops in five to 10 percent of infants infected in utero. The remainder of intrauterine infections are inapparent. CMV infection acquired later in life is generally inapparent but may cause a syndrome clinically similar to Epstein-Barr virus mononucleosis. CMV is the most common cause of posttransfusion mononucelosis like illness as a result of transfusion to nonimmune individuals (22).

Disseminated infection occurs in immunodeficient and immunosuppressed patients. CMV is the most common cause of posttransplant infection causing serious disease in about 25 percent of solid organ or bone marrow transplants patients (22).

Following primary infection, viremia usually continues for a few days or weeks. Prolonged viral excretion in saliva and urine may persist for weeks or months (84) and recurs throughout life.

1.2 Evidence of Exposure/Transmission of CMV

CMV transmission between patients proven by analysis of viral DNA (85,86) has occurred, but should be preventable by practising appropriate hygiene and handwashing (84,87-89).

1.3 Evidence of Occupational Transmission of CMV

Transmission of CMV to HCWs occurs rarely if at all. It has never been documented (84,90) or even inferred from seroconversion rates of nursery nurses (91-93).

A large prospective seroepidemiologic study of HCWs determined that primary acquisition of CMV was not an occupational risk for renal transplant and neonatal intensive care nurses (94).

Alder (84) noted, in a review of hospital transmission of CMV that pregnant HCWs do not need to be tested for CMV immunity before or during pregnancy for several reasons: the low incidence of infection, the difficulty in establishing a diagnosis of primary infection during pregnancy and the extreme uncertainties involved in counselling a woman who acquires CMV during pregnancy. The authors also stated pregnant HCWs should not be excluded from working with CMV positive patients as CMV transmission can be prevented by adhering to appropriate infection control practices.

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I - IV is required in addition to the following specific recommendations for CMV.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with CMV

2.1.1 Engineering Controls to Prevent HCWs Exposure to or Infection with CMV

See Section A:2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with CMV

See Section A: 2.1.2.

2.1.3 Occupational Health Work Practices to Prevent HCW Exposure to or Infection with CMV

OH should not reassign/exclude HCWs who are pregnant or planning a pregnancy from working with CMV infected patients. (84,85,91,93-100).

AII

OH should not screen HCWs who are pregnant or planning a pregnancy for immunity to CMV. Accuracy of tests used for the diagnosis of in utero CMV infections is undetermined; screening is of limited value and is not recommended (68,84,88,89,100).

AII

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment to Prevent HCW Exposure to or Infection with CMV

See Section A: 2.1.4.

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with CMV

2.2.1 Assessment of HCWs Exposure to CMV

2.2.1.1 Method of Transmission of CMV

CMV is transmitted by direct contact of mucous membrane with infectious excretions and secretions, especially saliva and urine or from infected blood/tissues/organs.

2.2.1.2 Definition of Occupational Exposure to CMV

OH should define HCW exposure as direct contact of mucous membrane with infectious saliva, genital secretions or urine.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential of communicability at the

time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is variable; illness following a transplant or transfusion with infected blood begins within 3-8 weeks. Infection acquired during birth is first demonstrable 3-12 weeks after delivery (22). The period of communicability, i.e. virus excreted in urine and saliva after primary infection may persist or be episodic for several years. Virus may be excreted for 5-6 years after neonatal infection. The virus persists as a latent infection in adults; intermittent excretion recurs with immunodeficiency and immunosuppression (22).

2.2.3 Criteria to Confirm the Diagnosis of CMV

Clinical illness – mononucelosis like syndrome; hepatosplenomegaly, pneumonia, retinitis, congenital infection

Plus laboratory evidence – viral culture of an appropriate clinical specimen positive for CMV; significant rise in CMV IgG antibody; or CMV viral DNA positive (available in some reference laboratories).

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with CMV

2.2.4.1 HCWs Exposed to CMV

There are no modifications of work practices or work restrictions for HCWs exposed to CMV.

OH should not reassign exposed HCWs who are pregnant or planning to be pregnant (84,85,91,93-100).

AII

2.2.4.2 HCW Symptomatic or Infected with CMV

OH should refer HCWs symptomatic or infected with CMV for confirmation of diagnosis and clinical management that may include laboratory investigation.

AIII

OH should not exclude HCWs with CMV illness (suspected or confirmed) from work. (85,95,101).

BIII

2.2.4.3 OH Management of CMV Outbreak

No outbreaks documented.

2.2.4.4 OH Reporting to Public Health of HCW with CMV

There is no reporting requirement for a single case; OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with CMV

OH should design education specific to CMV according to recommendations outlined in Section A - III and about:

- hand hygiene and appropriate use of gloves to reduce transmission (84,87-89)
- seroprevalence in population,
- risk to seronegative immunocompromised patients from transfusion or grafted tissue/organs
- possibility of sexual acquisition if seronegative
- occurrence of reactivation if seropositive
- evidence against occupational risk .

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with CMV

OH should refer to Section A – IV to develop an evaluation program specific to CMV.

AIII

DIPHTHERIA

1. Risk Assessment for Transmission of Diphtheria to HCWs

1.1 Clinical Significance of Diphtheria

Diphtheria is caused by *Corynebacterium diphtheriae*. It usually occurs as an acute membranous nasopharyngitis and /or obstructive laryngotracheitis and may have life-threatening complications including myocarditis and neurologic problems. Occasionally, other mucous membranes or skin may be infected (21). Asymptomatic colonization also occurs.

Strains of diphtheria may be toxigenic or non-toxigenic (21). Disease is associated with toxigenic strains that produce an exotoxin that acts locally to produce the laryngeal membrane and systemically to damage cells.

Infection can occur in immunized persons, however, disease is most common and most severe in those not immunized or partially immunized (21).

Exposure to toxigenic *C. diphtheriae* has become rare. Data from the Notifiable Disease Reporting System, Laboratory Centre for Disease Control (LCDC), indicate that two to five cases were reported annually between 1986 and 1995 inclusively. No cases were reported in 1996 and a single case was reported in 1997 a total of 33 cases for the 12-year period (102).

An important factor for the resurgence of diphtheria in the Russian Federation and the Ukraine was noted to be the presence of highly susceptible child and adult populations due to a breakdown in immunization systems (103).

Studies suggest between 20-60 percent of older adults in developed countries are susceptible to diphtheria because exposure to toxigenic *C. diphtheriae* has become rare and vaccine-induced immunity wanes over time unless periodic boosters are given (104-110).

A recent Canadian study of healthy adults revealed 20 percent lack protective antibody to diphtheria (20.3% of 1619 sera tested); the remaining sera demonstrated detectable antibody and presumed immunity (111).

Diphtheria protection can be reinforced by recommending persons requiring a booster dose of tetanus toxoid for wound management receive Td (diphtheria and tetanus toxoid combined) (5,102).

1.2 Evidence of Exposure/Transmission of Diphtheria

In a recent report 94 hospital employees were exposed to an unimmunized 25 -month old child who died of respiratory diphtheria. Closeness of contact was not systematically ascertained because cultures were not obtained and culture media was unavailable, Vaccination records were reviewed. Eight of ninety-four (9%) HCWs had received diphtheria toxoid within the previous 5 years, 74 (79%) during the previous 6-10 years, and 12 (13%) more than 10 years earlier. Of the 86 in the latter two groups, 72 were given a booster dose of diphtheria toxoid and 14 were

lost to follow-up. Of the 12 who had not received a dose within the previous 10 years, 4 received erythromycin prophylaxis and 8 were lost to follow-up. Sibling contacts of the case had pharyngeal cultures positive for the same strain, but no additional cases developed (112).

1.3 Evidence of Occupational Transmission of Diphtheria

During a prolonged community outbreak a hospital intern acquired symptomatic pharyngeal diphtheria and an asymptomatic pharyngeal infection was detected in a microbiologist who had surveyed the residential apartments of those infected (113).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I- IV is required in addition to the following specific recommendations for diphtheria.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Diphtheria

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Diphtheria

See Section A: 2.2.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Diphtheria

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Diphtheria

OH should document the immune status of HCW at preplacement exam.(5,103).

AII

OH should consider all HCWs to be susceptible to diphtheria because immunization may not be fully protective (102).

AII

OH should ensure all HCWs have a complete primary series of 3 doses of a combined tetanus and diphtheria (Td) preparation unless contraindicated (5,102).

AII

OH should ensure optimal levels of diphtheria antibody by updating immunization every 10 years or at a minimum by providing a Td vaccine booster at least once as an adult e.g. at age 50 if it has been 10 years or more since the last booster unless there are contraindications (5,102,113).

AII

OH should provide an injured HCW with a booster dose of Td when tetanus toxoid prophylaxis is indicated for wound management to promote diphtheria coverage(5,102).

AIII

2.1.4 Personal Protective Equipment to Prevent HCW Exposure to or Infection with Diphtheria

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a patient on Contact Precautions for suspected or confirmed diphtheria and to wear a gown if contact with the patient or environmental surfaces is likely (1).

AII

OH should advise HCWs to wear a surgical/procedure mask if within one metre of a patient on Droplet Precautions for suspected or confirmed diphtheria.

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Diphtheria

2.2.1 Assessment of HCW Exposure to Diphtheria

2.2.1.1 Method of Transmission of Diphtheria

Diphtheria is transmitted primarily by droplet contact of oral, nasal, or conjunctival mucous membrane with the oropharyngeal secretions of an infected individual or asymptomatic carrier; rarely, direct contact with skin lesions or articles soiled with lesion discharge of infected individuals.

2.2.1.2 Definition of Occupational Exposure to Diphtheria

OH should define HCW exposure as droplet contact of HCWs oral, nasal or conjunctival mucous membranes with oropharyngeal secretions infected with a toxigenic strain of *C. diphtheria;* direct contact of non-intact skin or mucous membranes with drainage from skin lesions infected with a toxigenic strain of *C. diphtheriae.*

AIII

2.2.2. Assessment of Source of HCW Exposure

OH should confirm the diagnosis of source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period for diphtheria is 2-5 days. The period of communicability is usually 2 weeks to several months if untreated. When treated, the period of communicability is defined as

the time until 2 sets of nasal and pharyngeal cultures taken at least 24 hour apart and at least 24 hours after cessation of effective antimicrobial therapy, are negative(1,102).

2.2.3 Criteria to Confirm the Diagnosis of Diphtheria

Clinical illness – upper respiratory tract infection with/without nasopharyngeal membrane, stridor or cardiac/neurologic involvement; cutaneous – variable.

Plus laboratory evidence – bacterial culture of appropriate clinical specimen positive for *Corynebacterium diphtheriae*; histopathology diagnositic for diphtheria.

Or clinical illness in a HCW who is epidemiologically linked to a case in the previous 2 weeks.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Diphtheria

2.2.4.1 HCW Exposed to Diphtheria

OH should consider all HCWs to be susceptible to diphtheria because immunization may not be fully protective (102).

AII

OH should promptly initiate identification of HCWs exposed to patients known or suspected to be infected with toxigenic *C. diphtheriae*(21,22,102).

AII

OH should refer exposed HCWs for clinical management that should include:

- evaluation for evidence of disease i.e., fever, sore throat or skin lesions daily for 7 days from last contact(102,112,114),

- acquisition of pre-antibiotic nasal and pharyngeal cultures(21,22,102,112,114),

- administration of antibiotics without waiting for culture results; consider intramuscular route, instead of the oral route if the exposed HCW is expected to be noncompliant with antibiotic regimen (21,22,102,114),

- administration of a dose of Td to exposed HCWs who:
  - are not fully immunized
  - do not know their immunization status
  - have not been immunized in the past 10 years (21,22,102,113).
- repeat of nasal and pharyngeal cultures (culture twice, at least 24 hours apart) of carriers at least two weeks after antibiotics are completed (21,22,102,112,114),
- re-treatment with antibiotics if cultures remain positive (102,112,114).

AIII

OH should exclude exposed HCWs until initial cultures are reported to be negative for toxigenic

C. diphtheriae (102,112).

BIII

2.2.4.2 HCW Colonized Symptomatic or Infected with Diphtheria

OH should refer HCWs symptomatic or infected with diphtheria for confirmation of diagnosis and for clinical management which should include laboratory investigation and antimicrobial treatment. If diphtheria is strongly suspected specific treatment with antibiotics and antitoxin should be initiated while studies are pending and should be continued even if cultures are reported to be negative (22).

AIII

OH should exclude HCWs asymptomatically carrying or infected with toxigenic *C. diphtheriae* until effective antibiotics have been taken for 2 weeks and after two sets of nasal and pharyngeal cultures taken 24 hours apart and at least 24 hours after cessation of antibiotics are negative and HCW is clinically reevaluated prior to return to work (101,102,102,112,115).

BIII

OH should inform Infection Control as soon as possible of a suspected or confirmed case of diphtheria.

AIII

2.2.4.3 OH Management of Diphtheria Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected.

AIII

OH may modify work restrictions as necessary in outbreak situations.

BIII

2.2.4.4 OH Reporting to Public Health of HCW with Diphtheria

OH should report case or suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Diphtheria

OH should design education specific to diphtheria according to recommendations outlined in Section A - III and about:

- immunization and prophylaxis recommendations
- importance for follow-up to obtain results of cultures and if prophylaxis not tolerated

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Diphtheria

OH should refer to Section A - IV to develop an evaluation program specific to diphtheria.

AIII

EPSTEIN-BARR VIRUS (EBV)

1. Risk Assessment for Transmission of EBV to HCWs

1.1 Clinical Significance of EBV

EBV is a herpes virus and is the most common cause of infectious mononucleosis. The spectrum of disease is extremely variable, ranging from asymptomatic to fatal infection (21).

1.2 Evidence of Exposure/Transmission of EBV

Infection frequently is contracted early in life, is common in lower socioeconomic groups, in which intrafamilial spread is common. Endemic infectious mononucleosis is common in group settings of adolescents, e.g. educational institutions (21).

1.3 Evidence of Occupational Transmission of EBV

Occupational transmission has rarely been reported (116,117).

Transmission to nine of 29 (31%) HCWs in an obstetrics and gynecology clinic occurred over a four week period and was considered to be due to sharing non-disposable poorly washed coffee cups. Five of the nine developed clinical disease with serological confirmation and four of the nine had primary asymptomatic EBV-infection (116).

A study done to investigate work-related infection with human herpes virus among dental personnel suggested a possible occupational risk of infection of EBV in dentists. The authors noted that since the emergence of Acquired Immune Deficiency syndrome cross infection practices in dentistry have changed greatly but that in this study no correlations could be detected between the use of protective workwear by dentists during their practising lifetimes and their serostatus of EBV and other herpes viruses(117).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required by legislation in addition to the following specific recommendations for EBV.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with EBV

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with EBV

See A: 2.1.2

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with EBV

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with EBV

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment to Prevent HCWs Exposure to or Infection with EBV

See Section A: 2.1.4.

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with EBV

2.2.1 Assessment of HCW Exposure to EBV

2.2.1.1 Method of Transmission of EBV

EBV is transmitted by direct contact of oral mucous membranes with infectious saliva or indirectly through contaminated items.

2.2.1.2 Definition of Occupational Exposure

OH should define HCW exposure as direct or indirect contact of oral mucous membranes with infectious saliva.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 30-50 days (1). The period of communicability is indeterminate (21).

2.2.3 Criteria to Confirm the Diagnosis of EBV

Clinical illness – fever, exudative pharyngitis, lymphadenopathy, hepatosplenomegaly.

Plus laboratory evidence – IgM antibody or viral capsid antigen (VCA) positive for EBV; significant rise in EBV IgG antibody; polymerase chain reaction (PCR) assay of an appropriate clinical specimen positive for EBV.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with EKC

2.2.4.1 HCW Exposed to EBV

There are no modifications of work practices or work restrictions for HCWs exposed to EBV.

2.2.4.2 HCW Symptomatic or Infected with EBV

There are no modifications of work practices or work restrictions for HCWs symptomatic or infected with EBV.

2.2.4.3 OH Management of EBV Outbreak

There are no work restrictions in outbreak situations.

2.2.4.4 OH Reporting to Public Health of HCW with EBV

There is no reporting requirement for a single case; OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with EBV

OH should design education specific to EBV according to recommendations outlined in Section A - III.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with EBV

OH should refer to Section A – IV to develop an evaluation program specific for EBV.

AIII

HERPES SIMPLEX VIRUS (HSV)

1. Risk Assessment for Transmission of HSV to HCWs

1.1 Clinical Significance of HSV

Herpes simplex lesions are caused by either HSV type 1 or 2. The viruses produce distinct clinical syndromes and may infect any body site. Like other herpes viruses, HSV infection is characterized by a localized primary lesion, latency and a tendency to localized recurrence. Reactivation of latent infection of HSV which is most common in adults results in herpes labialis (fever blisters or cold sores); or genital lesions. Primary and recurrent infection can occur, with or without symptoms (22).

Neonatal HSV infection is usually symptomatic and frequently severe with high morbidity and mortality. In immunocompromised patients severe local lesions and occasionally disseminated HSV with generalized vesicular skin lesions and visceral involvement can occur (21).

1.2 Evidence of Exposure/Transmission

Infection of the fingers (herpetic whitlow) is a distinct hazard for nurses, anesthesiologists (118), dentists, (119,120) respiratory care personnel, and other HCWs who may have direct (usually hand) contact with either oral lesions or respiratory secretions of infected patients (121,122).

Until additional studies determine how well gloves prevent the transmission of HSV from herpetic whitlow it is prudent to restrict HCWs with herpetic whitlow from working with patients until the lesions are healed (68).

Areas of non-intact skin, i.e minor cuts, abrasions, or other skin lesions are the most likely sites of HSV infection in HCWs (122).

Viral shedding can occur during recurrences and also in the absence of clinical signs (21,122-124).

1.3 Evidence of Occupational Transmission of HSV

The rate of work-related transmission is unknown because many infections go unrecognized or undiagnosed (122).

Authors of one report described a cluster of HSV infections involving seven HCWs with manifestations including keratoconjunctivitis, whitlow (3), perioral infection, pharyngitis and throat carriage from contact with infectious body secretions. They concluded that transmission was probably a result of poor compliance with infection control protocols or ineffective protocols (125).

Cross infection between patients and nurses in a pediatric intensive care unit (PICU) provided clear evidence that PICU HCWs risk acquiring serious herpetic infections, i.e. acute pharyngitis, whitlow from patients and vice-versa unless careful attention to infection prevention and control

is practiced (121).

A report of fifty-four cases of probable herpetic whitlow in HCWs occurring in a neurosurgical unit was published in 1959. The lesions were initially thought to be staphylococcal. Once viral studies were initiated, HSV was recovered from 13 HCWs (124).

The risk to patients posed by HCWs with orofacial herpes is unknown but transmission has been reported (126).

Postnatal transmission of HSV to an infant from a HCW with herpes labialis was confirmed by molecular analysis. The transmission occurred during direct tracheal suctioning for meconium aspiration in the delivery room. The physicians involved wore a mask as a barrier against resolving coldsores when aspirating the trachea by suctioning via an endotracheal tube (126).

Evidence is lacking that HCWs with genital infection pose any risk to patients (101).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for HSV.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with HSV

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with HSV

See Section A: 2.1.2

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with HSV

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with HSV

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with HSV

OH should advise HCWs to wear gloves to enter the single room or designated bedspace of a shared room of a neonatal patient suspected or confirmed to have HSV or an adult/pediatric patient suspected or confirmed to have mucocutaneous (disseminated or primary and extensive) HSV on Contact Precautions and to wear a gown if contact with the patient or environmental surfaces is likely (1).

AIII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with HSV

2.2.1 Assessment of HCW Exposure to HSV

2.2.1.1 Method of Transmission of HSV

HSV is transmitted by direct or indirect contact with primary or recurrent lesions, infectious saliva, genital secretions or amniotic fluid and possibly all body secretions/excretions from infected neonates.

2.2.1.2 Definition of Occupational Health Exposure to HSV

OH should define HCW exposure as direct or indirect contact of non-intact skin or mucous membranes with infectious oral or genital secretions, lesion drainage, amniotic fluid or any neonatal secretions or excretions.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 2 days to 2 weeks (1). The period of communicability is at least until lesions are healed and asymptomatic viral shedding may continue indefinitely; neonatal infection may involve shedding of virus for the duration of illness.

2.2.3 Criteria to Confirm Diagnosis of HSV

Clinical illness – primary or recurrent vesicular/ulcerative lesions of skin or mucous membrane; encephalitis/meningitis, localized CNS disease; generalized systemic infection of neonate.

Plus laboratory evidence – viral culture of vesicle fluid, tissue, CSF or mucous membrane positive for HSV; HSV viral DNA positive (available in some reference laboratories); four-fold rise in HSV IgG antibody.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with HSV

2.2.4.1 HCW Exposed to HSV

There are no modifications of work practices or work restrictions for HCWs exposed to HSV.

2.2.4.2 HCW Symptomatic/Infected with HSV

OH should instruct HCWs with orofacial or weeping lesions to wear a protective dressing during patient care to prevent hand contact with lesions (101) and emphasize handwashing (21).

AIII

OH should refer HCWs with herpetic whitlow or weeping lesions for confirmation of diagnosis and for clinical management that may include laboratory investigation and oral antiviral therapy (127).

AIII

OH should exclude HCWs with orofacial or weeping lesions on sites other than hands that cannot be covered with a protective dressing from having direct contact with high-risk patients, such as newborns, burn patients, or immunocompromised patients(68,118,121,126,128) and reassign to non-high-risk patients following assessment for fitness for work (21).

AII

OH should exclude HCWs with herpetic infections of the fingers or hands (herpetic whitlow) from having direct contact with patients until lesions are healed (68,118,121,129) or reassign to non-patient care tasks. Ensure that hygiene and handwashing is not compromised.

AIII

OH should assess the HCWs fitness for work by evaluating for resolution of symptoms, type of patient/work/physical setting, hygiene practices, what control measures can be utilized, and follow-up procedures (117,126).

AIII

OH should not exclude HCWs with genital HSV lesions (21).

AIII

2.2.4.3 OH Management of HSV Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected(122).

AIII

2.2.4.4 OH Reporting to Public Health of HCW with HSV

There is no reporting requirement for a single case; OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with HSV

OH should design education specific to HSV according to recommendations outlined in Section

A, III and about:

- the use of dressings to cover lesions,
- the importance of not touching lesions,
- the importance of not nuzzling/kissing newborn infants or a child with dermatitis (21),
- the hazards of sharing potentially contaminated facial/lip make-up.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with HSV

OH should refer to Section A - IV to develop an evaluation program specific to HSV.

AIII

INFLUENZA

1. Risk Assessment for Transmission of Influenza to HCWs

1.1 Clinical Significance of Influenza

Influenza is an acute viral disease of the respiratory tract characterized by fever, head-ache, myalgia, prostration, coryza, sore throat and cough (22).

Two main types of influenza virus are recognized; influenza A, associated with widespread outbreaks and pandemics, and influenza B (22).

Influenza is important because it causes yearly outbreaks with widespread morbidity including serious complications, like viral and bacterial pneumonia. During major epidemics severe illness and death occur; especially among the elderly and those with chronic cardiorespiratory and metabolic illnesses. The excess mortality, i.e. proportion of total deaths associated with pneumonia and influenza in excess of the proportion expected for the time of year varies from epidemic to epidemic related to the circulating virus strain (22).

1.2 Evidence of Exposure/Transmission to Influenza

Immunization is recognized as the single most effective way of preventing or attenuating illness for those at high risk of serious illness or death (5,130).

Influenza vaccination has substantial health related and economic benefits for healthy working adults (131)and was not associated with systemic side effects in healthy adults (132).

Immunization of HCWs working in Long Term Care reduces mortality and morbidity of patients under their care (5,130). It also reduces HCWs illness during the influenza season.

In a study to determine if vaccination of HCWs caring for long-term-care geriatric patients and vaccination of long-term-care patients reduces the patient incidence of influenza and associated morbidity and mortality, vaccinations of HCWs was associated with reductions in total patient mortality (from17% to 10%) and influenza-like illness. Vaccination of patients was not associated with significant effects on mortality (Ref. ID 6390).

A prospective randomized, double – blind, controlled study to determine the benefits of influenza vaccination among HCWs concluded that influenza vaccine is effective in preventing infection with influenza A and B in HCWs and may reduce reported days of work absence and febrile respiratory illness (133).

Employee absenteeism is an indirect method to assess the impact of influenza on HCWs (134).

In the majority of reports of nosocomial influenza, most HCWs have not been immunized during fall campaigns, and were not immunized or given chemoprophylaxis during outbreaks in their hospitals (135).

Immunization rates among HCWs in some hospitals have been reported to be as low as 2-16% (136,137).

One of the most important strategies for increasing immunization levels among HCWs is to educate about vaccine safety and the reasons for targeting HCWs for immunization (130,138,139).

Vaccine uptake by HCWs in institutions was increased by making vaccination accessible, e.g. the use of mobile carts (140,141) and by making vaccination a requirement of employment.

1.3 Evidence of Occupational Transmission of Influenza

One outbreak in a large (1156 bed) hospital resulted in influenza in 118 HCWs and 49 patients. The authors believed the outbreak was exacerbated by spread of the virus in the workplace to susceptible physicians, nurses and patients. Only 25 medical personnel had been immunized during the annual program that preceeded the outbreak. Active education and the use of a mobile cart to minimize inconvenience to staff resulted in immunizing about one-third of all medical personnel during the outbreak (141).

A 1996 review of influenza in US hospitals between 1959-1994 identified 17 reports of influenza outbreaks. HCWs were ill at the same time influenza was recognized in patients in most reports. However; HCW-to-patient influenza transmission was suspected in only five instances. The authors concluded that HCWs rarely comply with preventative measures, and few institutions have formal influenza control policies (135).

In a study to determine the effectiveness of immunization, the authors concluded that their data supports a policy of annual influenza vaccination. Their results showed influenza vaccine was effective in preventing infection by influenza A and B in HCWs and may reduce reported days of work absence and febrile respiratory illness (133).

Recommendations

Compliance with the recommendations for the components of an OH Program outlined in Section A, I-IV is required in addition to the following specific recommendations for influenza.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Influenza

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Influenza

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Influenza

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Influenza

OH should consider all HCWs to be susceptible to influenza because strains change annually, the immunization has an efficacy of about 70%, it has a short protective period of about 6 months and the vaccine components change annually (5).

AII

The National Advisory Committee on Immunization (NACI) advises providing annual immunization *only* to HCWs who have significant contact with individuals in high-risk groups. Such personnel include physicians, nurses, and others in both hospital and outpatient settings; HCWs of chronic care facilities who have contact with residents; providers of home care, visiting nurses or volunteers, and household members of persons at high risk (5,130). *However, all* HCWs are at greater risk of exposure to and transmission of influenza. *Therefore, irrespective of whether HCWs have direct contact with high-risk individuals*; OH should ensure *all* HCWs are offered annual influenza immunization unless there are contraindications (133,135,140,141).

AII

OH should consider making annual influenza immunization a requirement of employment.

AI

OH should ensure immunization initiatives are included in staffing contractual agreements with external service providers, e.g. emergency responders, academic institutions.

AIII

OH should consider various methods to increase accessibility, e.g. mobile carts (130,140,141), simultaneous immunization of patients and HCWs (142) to improve vaccine coverage (141,143,144)

AIII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Influenza

OH should advise HCWs to wear a surgical/procedure mask if within one metre of a pediatric patient on Droplet Precautions for suspected or confirmed influenza. Droplet precautions are optional for adult patients(1).

AII

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a pediatric patient on Contact Precautions for suspected or confirmed influenza and to wear a gown if contact with the patient or environmental surfaces is likely. Contact precautions are optional for adult patients(1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Influenza

2.2.1 Assessment of HCW Exposure to Influenza

2.2.1.1 Method of Transmission of Influenza

Influenza is transmitted primarily by droplet contact of the oral, nasal, or conjunctival mucous membrane with the oropharyngeal secretions of an infected individual and indirectly from hands and articles freshly soiled with discharges of the nose and throat of an acutely ill and coughing individual; possibly airborne.

2.2.1.2 Definition of Occupational Exposure to Influenza

OH should define HCW exposure as droplet or indirect contact of oral, nasal, or conjunctival mucous membranes with infectious respiratory secretions.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 1-3 days. The period of communicability is 1 day before to 7 days after the onset of symptoms and may be longer in infants (1).

2.2.3 Criteria to Confirm the Diagnosis of Influenza

Clinical illness – sudden onset of fever, chills, headache, myalgias, respiratory tract symptoms.

Plus laboratory evidence – viral culture of the nasopharynx positive for influenza; significant rise in influenza IgG antibody.

Or clinical illness in a HCW who is epidemiologically linked to a case during an outbreak.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Influenza

2.2.4.1 HCW Exposure to Influenza

OH should consider all HCWs to be susceptible to influenza because strains change annually, the immunization has an efficacy of about 70%, has a short protective period of about 6 months and the vaccine components change annually (5).

AII

OH should arrange for immunization of unimmunized exposed HCWs as soon as possible.

AII

There are no work restrictions for HCWs exposed to influenza.

OH should refer immunocompromised, unimmunized, exposed HCWs for clinical management that may include consideration of immunization and antiviral prophylaxis (130,134).

BIII

2.2.4.2 HCW Symptomatic/Infected with Influenza

OH should refer HCW symptomatic or infected with influenza for confirmation of diagnosis and for clinical management that may include:

- laboratory investigation; obtaining cultures/direct antigen detection
- considering antiviral therapy as a supplement to vaccine if the interval since immunization is less than two weeks (130)

AIII

OH should inform Infection Control of a case of suspected/confirmed Influenza as soon as possible if there has been little to no influenza activity.

AIII

OH should exclude HCW symptomatic/infected with influenza from work until 7 days after the onset of symptoms (1) unless immunized at least 2 weeks previously and HCW has started antiviral therapy.

AIII

OH should minimize contact of HCWs with acute respiratory infection with high-risk patients, (ie. pediatric patients with significant hemodynamic congenital heart disease, immunocompromised patients).

BIII

2.2.4.3 OH Management of Influenza Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria of diagnosis during the influenza season.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected.

AIII

OH should refer unimmunized HCWs for clinical management that may include:

- prescribing antiviral prophylaxis for the duration of the outbreak, if vaccine unavailable, vaccine was given less than 2 weeks prior to exposure or is contraindicated,
- immunization and prescribing a 2 week course of antiviral prophylaxis

(5,130,134,145).

AIII

OH should consider the need for flexibility and re-evaluation of work restrictions in the outbreak management plan to maintain adequate staffing as necessary in outbreak situations.

AIII

OH should consider limiting staff movement among affected and non-affected units/facilities during an outbreak situation.

BIII

OH should advise HCWs who are symptomatic/infected with influenza to not work in units/facilities unaffected with influenza.

BIII

OH should exclude unimmunized HCWs who refuse to co-operate with the outbreak plan (antiviral prophylaxis and immunization) (146).

AII

2.2.4.2 OH Reporting to Public Health of HCW with Influenza

There is no requirement to report a single case; OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Influenza

OH should design education specific to influenza according to recommendations outlined in Section A – III and about:

- various types of influenza (type A/type B)
- difference between an upper respiratory infection and influenza
- risk of infection and subsequent complications in high-risk groups
- why HCWs are targeted for immunization (138)
- importance and safety of immunization for staff/patients
- why susceptible even if immunized
- prophylaxis recommendations.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Influenza

OH should refer to Section A - IV to develop an evaluation program specific to influenza including;

rate of employee absenteeism during influenza season,

vaccination rate,

number of occupational cases,
number of nosocomial transmission due to HCW transmission.

AIII

MEASLES (Rubeola)

1. Risk Assessment for Transmission of Measles to HCWs

1.1 Clinical Significance

Measles is a highly communicable febrile viral illness that is characterized by Koplik spots on the buccal mucosa, cough, coryza, conjunctivitis and by an erythematous rash. Complications may result from viral replication or bacterial superinfection and include otitis media, pneumonia, croup, diarrhea and encephalitis. The disease is more severe in infants, adults and immunocompromised than in healthy children (22).

Twenty-six percent of HCWs who acquired measles were reported to require hospitalizations averaging seven days for such complications as pneumonia and encephalopathy; death occurs occasionally (147).

1.2 Evidence of Exposure/Transmission

Measles virus can survive at least 2 hours in evaporated droplets, and the airborne spread of these fine particles can be implicated in many closed settings (148) as evidenced by outbreaks in health care settings that occurred when the index patients were no longer present (149,150).

Since national reporting for measles began in Canada in 1924, the annual incidence has ranged from 0.04-767 cases per 100,000 population. In 1998, Canada had the lowest level of measles activity ever recorded with only 12 cases reported. There were a total of 581 cases reported in 1997 (151).

It was estimated about ten percent of vaccinated children remain unprotected after a single dose of vaccine (5). Canadian territories and provinces have committed to eliminate measles by the year 2005. A two-dose vaccine schedule has been adopted and augmented by mass vaccination "catch-up" programs and heightened surveillance (151,152).

Two recent studies reported the seroprevalence of HCWs and found six to ten percent of new or current medical personnel lacked measurable antibodies and thus are presumed to be susceptible to infection (153,154).

A survey to investigate the role medical students play in measles and rubella outbreaks in Canada and the United States found that since 1981 nine percent of health departments have recorded at least one outbreak of rubella or measles in which medical students were specifically implicated as sources or vectors (155).

In Canada, the National Advisory Committee on Immunization (NACI) states persons born before 1970 have probably been infected naturally and may usually be considered to be immune (5).

The Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC) in the United States, state that birth before 1957 is

generally considered acceptable evidence of measles immunity although recommendatations state vaccination should be considered for all susceptible HCWs including those born before 1957 (115). Other reports challenge the 1957 rule (147,153,154,156,157).

Between 1985 and 1989, physicians and nurses were estimated to be two and eight times, respectively, more likely to acquire measles than adults who are not HCWs (158).

Due to an increase of measles, mumps and rubella among United States adults, a study to determine antibody prevalence data among United States army recruits was completed. The authors reported as many as 16-18 percent of young adults may be susceptible to measles, mumps and rubella (159). The opportunity to assure immunity to these viruses should not be overlooked (147).

1.3 Evidence of Occupational Transmission of Measles

From 1985 to 1991, four percent of all US cases (147)("CDC unpublished data") of measles occurred in medical settings and almost half of these were in hospital inpatient units. Physicians' offices and hospital emergency departments accounted for the other half. Adults (over 18 years) accounted for 41 percent of cases in medical settings, 14 percent were patients and 64 percent were HCWs. The remainder included visitors or persons for whom occupations could not be determined. Of the HCWs, nurses accounted for the largest group who acquire measles at work (29%) and physicians accounted for 15 percent. Other groups include laboratory, radiology personnel and clerks for 11 percent each, nursing assistants, medical and nursing students each at four percent (147,158).

In a review of measles cases occurring in medical settings in less than a three month period 8 of 31 cases, (26%) occurred in HCWs and 16 percent occurred in patients or visitors to the medical facilities. Cases of measles occurred in HCWs who were not required to have proof of measles immunity. The authors concluded HCWs were at higher risk of measles than the general adult population due to deficiencies in, and lack of implementation of published guidelines (160).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for measles.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Measles

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Measles

OH should liaise with Infection Control and Administration to ensure that appropriately maintained negative pressure rooms are available for patients suspected or confirmed to have measles(1).

AII

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Measles

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Measles

OH should document HCW immune status at preplacement exam (5,50,153,154) **(5007*)**.

AII

OH should consider HCWs to be immune to measles if born before 1970; if born in 1970 or after with evidence of two doses of live measles containing vaccine, physician-diagnosed measles or documentation of measles IgG (5,147,153,154,154,161,162).

AII

OH should immunize all susceptible, HCWs born in 1970 or after with two doses of live measles containing vaccine given as measles, mumps, rubella (MMR) at least one month apart unless there are contraindications(5,115,147,152-154,156,157,161).

AII

OH should ensure a second dose of measles vaccine (MMR) is given to HCWs born in 1970 or after and who have previously received only one dose, to provide optimal protection (5).

AIII

OH should develop a program to ensure all newly employed HCWs with patient contact are immunized and consider a "catch-up" program for others; workplaces may operationalize this differently (5,152,161).

AIII

OH should not routinely initiate a serologic testing program to detect HCWs who are not immune unless it is determined to be cost-effective for the workplace(5) Grawbowski & Markowitz 1991 ID: 5007.

BIII

OH should not exclude recently immunized HCWs with a vaccine-related rash.

BIII

OH should ensure that HCWs who are not immune do not work with patients suspected or confirmed to have measles (1).

AII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Measles

OH should ensure that HCWs who are not immune and absolutely must enter the isolation room are provided with an appropriate mask for respiratory protection against measles.

The masks should meet or exceed the following recommendations:

-filters particles one micron in size

-has a 95% filter efficiency, tested in the unloaded state; and
-provides a tight facial seal (less than 10% facial seal leak)(1).

AIII

OH should advise HCWs who are immune that a mask is not required (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Measles

2.2.1 Assessment of HCW Exposure to Measles

2.2.1.1 Method of Transmission of Measles

Measles is transmitted by inhalation of airborne virus by a non-immune individual.

2.2.1.2 Definition of Occupational Exposure to Measles

OH should define exposure as a non-immune HCW spending any time in an enclosed airspace, i.e. same room or face-to-face contact with an infectious patient in an open area or being in a room supplied by a ventilation system that recirculates contaminated air within 2 hours of an infectious patient being there within the 5 days before to 4 days after the onset of the rash.

AIII

2.2.2 Assessment of Source of HCW Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 7- 18 days. The period of communicability is 5 days before the onset of rash (1-2 days before onset of initial symptoms) until 4 days after onset of rash; may be longer in immuno-compromised individuals (1).

2.2.3 Criteria to Confirm the Diagnosis of Measles

Clinical illness – fever, cough, coryza, conjunctivitis and erythematous maculopapular rash, Koplik spots.

Plus laboratory evidence – IgM antibody positive for measles; four-fold rise in measles IgG antibody; viral culture of an appropriate clinical specimen positive for measles.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Measles

2.2.4.1 HCW Exposed to Measles

OH should determine the immune status of the exposed HCW. If the HCW immune status is unknown, or only one dose of vaccine given, OH should test the HCW for IgG antibody.

AII

OH should consider the exposed HCW to be immune to measles if born before 1970; if born in 1970 or after with evidence of two doses of live measles containing vaccine, physician-diagnosed measles or documentation of measles IgG (5,147,153,154,154,158,161,162).

AII

OH should immunize the exposed non-immune HCW with a second dose of live measles vaccine given as measles, mumps, rubella within 72 hours of the exposure if the HCW has a history of only one dose of vaccine, unless immunization is contraindicated (5,158).

AII

OH should refer the exposed HCW for clinical management that should include;

- immunization with measles vaccine within 3 days of exposure unless contraindicated (5,21).

- administration of immune globulin to susceptible HCW within 6 days of exposure if it is more than 3 days post exposure or vaccine is contraindicated. The dose of immune globulin for exposed individuals, who have underlying malignant disease or who are otherwise immunologically deficient differs from that for healthy individuals. Administration of immune globulin does not alter work restrictions(5).

    - immunization with measles vaccine 5 months after immune globulin is given if exposure did not result in infection(5).

AII

OH should refer exposed pregnant HCWs to their physicians for clinical management.

BIII

OH should exclude non-immune exposed HCWs from day 5 after their first exposure until day 21 after their last exposure regardless if post exposure immunization or immune globulin is given(50).

AIII

OH should not exclude HCWs with a history of a single dose of measles vaccine if a second dose is given within 72 hours of exposure or if found to be antibody positive following one dose of vaccine.

AIII

2.2.4.2 HCW Symptomatic/Infected with Measles

OH should refer HCWs with measles for confirmation of diagnosis and for clinical management that should include laboratory investigation and management of complications, i.e. pneumonia.

AIII

OH should exclude HCWs with measles until 4 days after the rash first appeared(1,21).

AIII

OH should inform Infection Control as soon as possible of a suspected or confirmed case of measles.

AIII

2.2.4.3 OH Management of Measles Outbreak

OH should investigate for the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control /Public Health if an outbreak is suspected/confirmed.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Measles

OH should report a case or suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Measles

OH should design education specific to measles according to recommendations outlined in Section A – III.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Measles

OH should refer to Section A – IV to develop an evaluation program specific to measles.

AIII

MENINGOCOCCUS *(Neisseria meningitidis)*

1. Risk Assessment for Transmission of Meningococcus to HCWs

1.1 Clinical Significance of Meningococcus

Neisseria meningitidis causes an acute bacterial infection resulting in several major clinical conditions including bacteremia, sepsis, meningitis and meningococcemia.
Although the most common and severe pathological presentations are meningitis and meningococcemia, asymptomatic carriage is commonly found (163).

1.2 Evidence of Exposure/Transmission of Meningococcus

In Canada, there were 304 cases of invasive meningococcal disease reported during 1995, for an incidence of 1.0 per 100,000 population. During 1996, there was a 13% decrease with 265 cases reported for an incidence of 0.9.. During the past decade, incidence in Canada has varied from a peak of 1.6 per 100,000 population during 1989 and 1990 to 0.9 in 1996, the lowest rate in 11 years (164).

1.3 Evidence of Occupational Transmission of Meningococcus

HCWs were not found to be at any greater risk of acquiring infection than the general population (165), even when exposed to a patient with fulminant meningococcemia (166).

The risk of HCWs acquiring disease from casual contact, e.g. housekeeping or delivering food to an unisolated patient with unrecognized meningococcal pneumonia is negligible (167).

Transmission to HCWs has not been reported(167,168) although rare transmission to other patients has occurred where the source patient has meningococcal pneumonia resulting in heavy airborne dispersal of organisms.

A 1978 CDC report described a nurse developing meningococcemia three days after assisting with intubating and suctioning a vomiting patient with meningococcemia and meningitis. HCWs assisting with these procedures did not wear masks or follow other isolation procedures and did not receive prophylaxis following exposure (169).

A 1972 JAMA article entitled *Some recollections of the Meningococcal Diseases* noted that at least four HCWs developed disease following performing mouth-to-mouth resuscitation on infected patients. There was no additional information on the use of barriers, or prophylaxis (170).

A pediatrician developed meningococcal meningitis after performing endotracheal intubation without protection on a child who was suspected of having meningococcus (171).

Probable laboratory acquired infection has been reported (172,173). A laboratory worker who prepared a concentrated solution of meningococci without the use of protective barriers died from a strain identical to that of the isolate she worked on (173). Laboratory workers are

probably not at increased risk of infection when standard microbiology practices are followed, i.e. gown, gloves, use of biologic safety cabinets (172).

Transmission from carriers to HCWs has not been reported (101).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in section A, I-IV is required in addition to the following specific recommendations for Meningococcus.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Meningococcus

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Meningococcus

See Section A: 2.1.2

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Meningococcus

Administration should ensure there are processes in place to provide appropriate contact tracing for Emergency Responders (13).

AIII

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Meningococcus

There are no recommendations for routine immunization (5).

AIII

OH should develop in cooperation with appropriate stakeholders a process for involving Emergency Responders when considering notification of contacts.

AIII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Meningococcus

OH should advise HCWs to wear a surgical/procedure mask if within one metre of a patient on Droplet precautions for suspected or confirmed meningococcus (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Meningococcus

2.2.1 Assessment of HCW Exposure to Meningococcus

2.2.1.1 Method of Transmission of Meningococcus

Meningococcus is transmitted by direct and droplet contact of oral mucous membrane with infectious oral or nasopharyngeal secretions (174).

2.2.1.2 Definition of Occupational Exposure to Meningococcus

OH should define HCW exposure as direct contact of HCWs oral mucous membranes during mouth – to –mouth resuscitation or resulting from a spray of infectious oral or nasopharyngeal secretions within 7 days of onset and up to 24 hours after start of effective therapy.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 2-10 days. The period of communicability is 7 days prior to onset of symptoms until 24 hours after effective therapy is started (1).

2.2.3 Criteria to Confirm the Diagnosis of Meningococcus

Clinical illness – meningitis or meningococcemia with headache, fever, stiff neck, chills, malaise, prostration and rash.

Plus laboratory evidence – bacterial cultures of blood, CSF or other sterile site positive for *Neisseria meningitidis*.

Or clinical illness in a HCW who is epidemiologically linked to a case in the previous 7 days

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Meningococcus

2.2.4.1 HCW Exposed to Meningococcus

OH should refer exposed HCWs for clinical management that should include:

- chemoprophylaxis given within 10 days after the most recent exposure (174) or as specified by provincial Public Health authorities.

AII

OH should not routinely culture close contacts (174).

AIII

Post-exposure immunization is not recommended(5,174).

AIII

There are no work restrictions for HCWs exposed to meningococcus.

OH should ensure that Emergency Responders are included in identification of exposed HCWs and that Public Health is notified in a timely manner regarding post-exposure management (8).

AIII

2.2.4.2 HCW Colonized/Symptomatic/Infected with Meningococcus

OH should refer HCWs symptomatic/infected with meningococcus for confirmation of diagnosis and for clinical management that should include:

- laboratory investigation
- antibiotics for treatment of infection (21,171,174).

AII

OH should not exclude HCWs colonized with *Neiserria meningitidis* from work.

AIII

OH should exclude HCWs symptomatic/infected with meningococcus until 24 hours after start of effective therapy (175).

AIII

OH should not refer unexposed HCWs found to have nasopharyngeal carriage/colonization with *Neiserria meningitidis* for prophylaxis/treatment (163)as the role of antibiotics in eliminating carriage is limited to those persons exposed to a case.

AIII

OH should inform Infection Control of suspected or confirmed case as soon as possible.

AIII

2.2.4.3 OH Management of Meningococcus Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control and Public Health if an outbreak is suspected (174).

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Meningococcus

OH should report case or suspected/confirmed outbreak as soon as possible to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Meningococcus

OH should develop education specific to meningococcus according to recommendations outlined

in Section A – III including that prophylaxis is required only for those who meet the definition of exposure.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Meningococcus

OH should refer to Section A - IV to develop an evaluation program specific to meningococcus including;

- number of HCWs receiving prophylaxis
- number of HCWs with preventable exposures.

AIII

MUMPS

1. Risk Assessment for Transmission of Mumps to HCWs

1.1 Clinical Significance of Mumps

Mumps is an acute viral disease caused by a paramyxovirus. It is characterized by fever, swelling and tenderness of one or more salivary glands especially the parotid gland. Neurologic involvement and orchitis may occur without salivary gland involvement. Infection during the first trimester of pregnancy may increase the rate of spontaneous abortion. There is no evidence that mumps during pregnancy causes congenital malformations (22).

1.2 Evidence of Exposure/Transmission of Mumps

About one-third of exposed susceptible people have inapparent infections (22).

Due to an increase of measles, mumps and rubella among United States adults, a study to determine antibody prevalence data among United States army recruits was published in 1991. The authors reported that as many as 16-18 percent of young adults may be susceptible to measles, mumps and rubella (159). The opportunity to assure immunity to these viruses should not be overlooked (147).

Serological studies show that more than 85% of people have had mumps infection by adult life in the absence of immunization (22).

Since the introduction of the mumps vaccine in Canada, the incidence of clinical mumps has decreased by 90% (5).

Mumps transmission can be sustained among the few persons not protected by vaccination as evidenced by outbreaks occurring in highly vaccinated populations (21).

1.3 Evidence of Occupational Transmission of Mumps

Outbreaks of mumps have been reported in hospitals only infrequently (176-178) and may not be identified due to the relatively long incubation period in comparison to short hospital stays of most patients (178).

Mumps poses a small but real risk to both patients and staff in hospital settings. An outbreak (community and hospital/long-term care involvement) in Tennessee in 1986-7 reported at least six HCWs developed mumps after exposure to infectious patients. Personal Protective Equipment, i.e. masks were not reported to be worn (178).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I - IV is required in addition to the following specific recommendations for mumps.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Mumps

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Mumps

See Section A: 2.1.2

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Mumps

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Mumps

OH should document HCW immune status at preplacement exam (5).

AII

OH should consider HCWs to be immune to mumps if born before 1970; if born in 1970 or after with evidence of one live dose of mumps containing vaccine, physician diagnosed mumps or documentation of mumps IgG (5).

AII

OH should immunize all susceptible HCWs with a single dose of mumps containing vaccine given as measles, mumps, rubella (MMR) unless there are contraindications (5,147,159,176,178).

AII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Mumps

OH should advise non-immune HCWs to wear a surgical/procedure mask if within one metre of a patient on Droplet Precautions for suspected or confirmed mumps (1).

AII

2.2.1 Assessment of HCW Exposure to Mumps

2.2.1.1 Method of Transmission of Mumps

Mumps is transmitted by direct and droplet contact of oral, nasal and conjunctival mucous membrane of a non-immune person with infectious saliva.

2.2.1.2 Definition of Occupational Exposure to Mumps

OH should define HCW exposure as direct or droplet contact of oral, nasal, or conjunctival mucous membranes of a non-immune HCW with infectious saliva during the 2 days before and up to 9 days after the onset of parotid swelling.

AIII

2.2.2 Assessment of Source of HCW Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 12-25 days. The period of communicability is 2 days before to 9 days after the onset of parotid swelling (1).

2.2.3 Criteria to Confirm the Diagnosis of Mumps

Clinical illness – swelling of the salivary gland(s), fever, orchitis, meningitis.

Plus laboratory evidence – IgM antibody positive for mumps; four-fold rise in mumps IgG antibody; viral culture of an appropriate clinical specimen positive for mumps.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Mumps

2.2.4.1 HCW Exposed to Mumps

OH should determine the immune status of the HCW. If immunity of the HCW is unknown, OH should test the HCW for antibody.

AIII

OH should consider HCWs to be immune to mumps if born before 1970; if born in 1970 or after with evidence of one dose of live mumps containing vaccine, physician-diagnosed mumps, or documentation of mumps IgG (5).

AIII

OH should consider mumps immunization given as measles, mumps rubella (MMR) for non-immune HCWs if the HCW exposure did not result in clinical disease and there are no contraindications to immunization.

AIII

OH should exclude non-immune exposed HCWs from work from the 10^{th} day after their first exposure through the 26^{th} day after their last exposure (1).

AIII

2.2.4.2 HCW Symptomatic or Infected with Mumps

OH should refer HCWs symptomatic/infected with mumps for confirmation of diagnosis and for clinical management that may include laboratory investigation .

AIII

OH should exclude a HCW with mumps from work until 9 days after the onset of parotid swelling (1).

AIII

OH should inform Infection Control of a case of mumps.

AIII

2.2.4.3 OH Management of a Mumps Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control /Public Health if an outbreak suspected.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Mumps

OH should report a case or suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Mumps

OH should develop education specific to mumps according to recommendations outlined in Section A – III.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Mumps

OH should refer to Section A – IV to develop an evaluation program for mumps.

AIII

PARVOVIRUS B 19

1. Risk Assessment for Transmission of Parvovirus B 19 to HCWs

1.1 Clinical Significance of Parvovirus B 19

Infection with parvovirus B 19 usually manifests as erythema infectiosum in children (Fifth disease), which is characterized by mild systemic symptoms, including fever, and frequently a distinctive rash. Many cases are asymptomatic, and symptomatic cases are usually self-limited. Over one-half of adults have evidence of past infection and are probably not susceptible to reinfection. Parvovirus B 19 is also the primary etiologic agent of transient aplastic crisis in patients with chronic hemolytic anemias (21).

Those at risk for serious disease include:

1) patients with chronic hemolytic anemia who may develop aplastic crisis during acute infection,
2) non-immune pregnant women in whom the virus can cause fetal hydrops and death,
3) immunodeficient individuals, including those with AIDS and hematologic malignancies, who may develop chronic anemia (179).

The risk of fetal death is less than 10% after proven maternal infection in the first half of pregnancy and is less in the second half (21).

Due to the high prevalence of immunity to parvovirus B 19, the low incidence of ill effects on the fetus, and the fact that exclusion can only reduce but not eliminate the risk of exposure, routine exclusion of pregnant women from the workplace where erythema infectiosum is occurring is not recommended (180).

Pregnant women who were exposed to an individual in the incubation period of erythema infectiosum or in aplastic crisis should have the relatively low potential risk explained to them, and the option of serological testing offered (21,180).

1.2 Evidence of Exposure/Transmission of Parvovirus B 19

The risk of transmission differs with the different parvovirus B 19 syndromes (181).

1.3 Evidence of Occupational Transmission of Parvovirus B 19

Parvovirus B 19 transmission to HCWs has been suggested in numerous reports (182-187) but none included control groups of adequate size. All but one investigation occurred following the recognition of an outbreak of parvovirus B 19 disease among HCWs (187). When control groups were used, an increased risk of transmission of parvovirus B 19 to HCWs was not identified, despite prolonged exposures to patients with transient aplastic crisis who were not placed in contact isolation (187).

In a study to evaluate the risk of transmission of parvovirus B 19 to HCWs following exposure to patients with transient aplastic crisis, the authors were unable to identify any increased risk of

nosocomial transmission of parvovirus B 19 to HCWs (181).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for parvovirus B 19.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Parvovirus B 19

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Parvovirus B 19

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Parvovirus B 19

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Parvovirus B 19

OH should not routinely exclude pregnant HCWs from caring for patients with parvovirus B19 (179-181) because most persons are not infectious by the time of the onset of rash when infection is first recognized (179).

AII

OH should provide education to pregnant HCWs on the potential risks to the fetus from parvovirus B19 infection and about the preventative measures that may reduce these risks (179,180).

AIII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Parvovirus B 19

OH should advise HCWs to wear a surgical/procedure mask if within one metre of a patient on Droplet precautions for suspected or confirmed transient aplastic or erythrocyte crisis (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Parvovirus B 19

2.2.1 Assessment of HCW Exposure to Parvovirus B 19

2.2.1.1 Method of Transmission of Parvovirus B 19

Parvovirus B 19 is transmitted by droplet and direct contact of the oral, nasal, or conjunctival

mucous membrane with the respiratory secretions of an infectious individual.

2.2.1.2 Definition of Occupational Exposure to Parvovirus B 19

OH should define HCW exposure as a non-immune HCW having direct or droplet contact of oral, nasal, or conjuctival mucous membranes with infectious respiratory secretions.

AIII

2.2.2 Assessment of Source of HCW Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period of parvovirus B 19 is 4-21days. The period of communicability of transient aplastic or erythrocyte crisis is for 7 days. Patients with Fifth disease are no longer infectious by the time the rash appears. Immunocompromised patients with chronic infection may shed the virus for a prolonged period (1).

AIII

2.2.3 Criteria to Confirm the Diagnosis of Parvovirus B 19

Clinical illness – mild systemic symptoms of fever, malaise, myalgias, headache followed 7-10 later with a distinctive rash of red cheeks, circumoral pallor and a symmetrical maculopapular, lacelike rash on arms, trunk, buttocks and thighs which fluctuates in intensity with environmental change.

Plus laboratory evidence – IgM antibody positive for parvovirus B 19; presence of four-fold rise in parvovirus B 19 IgG antibody.

Or clinical illness in a HCW who is epidemiologically linked to a case in the previous three weeks.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Parvovirus B 19

2.2.4.1 HCW Exposed to Parvovirus B 19

OH should refer pregnant HCWs exposed to children in the incubation period of erythema infectiosum or who were in aplastic crisis caused by parvovirus B 19 to their physicians for clinical management that may include laboratory investigation (21).

AIII

There are no modifications to work practices or work restrictions for HCWs exposed to parvovirus B 19 (179,180).

2.2.4.2 HCW Symptomatic/Infected with Parvovirus B 19

OH should refer pregnant HCWs who are symptomatic/infected with parvovirus B 19 to their physicians for confirmation of diagnosis and for clinical management that may include laboratory investigation.

AIII

There are no modifications to work practices or work restrictions for HCWs symptomatic/infected with parvovirus B 19.

2.2.4.3 OH Management of Parvovirus B 19 Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected.

AIII

There are no work restrictions in outbreak situations.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Parvovirus B 19

There is no reporting requirement for a single case; OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Parvovirus B 19

OH should design education specific to parvovirus B 19 according to recommendations outlined in Section A - III and about:

- minimal risk of transmission to HCWs,
- high rate of immunity,
- recommending handwashing as being a practical and effective measure to decrease parvovirus B19 transmission (179),
- transmission being possible during the incubation period of erythema infectiosum but that once the rash develops the patient is no longer infectious,
- the relatively low potential risk to the fetus if maternal parvovirus infection occurs, i.e. in most cases of parvovirus B 19 infection in pregnancy the fetus has not been adversely affected.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Parvovirus B 19

OH should refer to Section A – IV to develop an evaluation program specific to parvovirus B 19.

AIII

PEDICULOSIS (LICE)

1. Risk Assessment for Transmission of Pediculosis to HCWs

1.1 Clinical Significance of Pediculosis

Pediculosis is an infestation with any of three species of lice; *Pediculus humanus capitus*, *Pediculus humanus corporis*, or *Phthirus pubis* causing human head lice, body lice and pubic/crab lice respectively. All three only infest humans and are most often localized to one part of the body (188).

Head lice infestation in child care and school aged children is common (21).

1.2 Evidence of Exposure/Transmission of Pediculosis

There is negligible risk of transmission of body lice or pubic/crab lice in a hospital setting and there is a low risk of transmission of head lice unless close HCW-to-patient head to head contact occurs(188).

1.3 Evidence of Occupational Transmission of Pediculosis

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I - IV is required in addition to the following specific recommendations for pediculosis.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Pediculosis

2.1.1 Engineering Controls for Pediculosis

Administration should ensure there is consideration for plastic covered pillows and protected chairs in communal areas, e.g. psychiatry units, community health centers, physiotherapy and emergency departments.

AIII

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Pediculosis

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Pediculosis

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with

Pediculosis

OH should advise HCWs to wear gloves when having direct contact with a patient infested with lice (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Pediculosis

2.2.1 Assessment of HCW Exposure to Pediculosis

2.2.1.1 Method of Transmission of Pediculosis

Head lice are transmitted by direct head to head contact with an infested individual or indirectly by objects used by them especially shared clothing and headgear. Body lice are transmitted by direct skin to skin contact or exchange of infested clothing or bedding. Transmission of crab lice occurs by direct skin to skin transfer.

2.2.1.2 Definition of Occupational Exposure to Pediculosis

OH should define HCW exposure to head lice as direct or indirect hair-to-hair contact with a patient infested with head lice; body lice exposure is defined as direct skin-to-skin contact or skin contact with clothing or bedding of an infested person prior to 24 hours of effective treatment. Crab lice transmission is not applicable in an OH setting.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 6-10 days. The period of communicability continues until 24 hours after effective treatment of lice and ova(1).

2.2.3 Criteria to Confirm the Diagnosis of Pediculosis

Clinical illness – intense itching of affected body site and the presence of eggs (nits) on the hair shaft or occasionally visible lice.

No laboratory evidence.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Pediculosis

2.2.4.1 HCW Exposed to Pediculosis

There are no modifications to work practices or work restrictions for HCWs exposed to pediculosis (21,50,101).

2.2.4.2 HCW Symptomatic or Infested with Pediculosis

OH should refer HCWs with symptoms or infestation with pediculosis for confirmation of diagnosis and for clinical management that should include provision of effective pediculocide. (21,50,101).

BII

OH should exclude HCWs infested with pediculosis until completion of effective therapy, i.e. usually 24 hours after one application of appropriately applied pediculocide (50)and the HCWs are re-evaluated prior to return to work (189).

AII

OH should advise HCWs that exposed family members and intimate contacts should seek medical evaluation from a public health nurse/community health centre or physicians regarding evaluation of risk, prophylaxis, diagnosis and or treatment.

BIII

OH should advise HCWs to return for re-evaluation prior to return to work.

AIII

2.2.4.3 OH Management of Pediculosis Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control and or Public Health if an outbreak is suspected.

AIII

OH may modify work restrictions as necessary in outbreak situations.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Pediculosis

OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Pediculosis

OH should develop education specific to pediculosis according to recommendations outlined in Section A - III and the:

- need for symptomatic family members and intimate contacts of HCW to seek

medical evaluation,
- recommendations for prophylaxis,
- need for individual to bathe and change their clothing after treatment (21),
- importance of laundry handling, i.e. hot water washing (55degrees C or 131F for 20 minutes) and drying at hot cycles or drycleaning of infested bedding/clothing to destroy eggs and lice (22) or storage in a sealed plastic bag for 10 days (21),
- importance to soak brushes/combs in pediculocide or hot water (21),
- recommendation that disinfecting furniture is unnecessary; vacuuming can be done (21),
- importance of following treatment product instructions carefully,
- the fact that no treatment is completely effective so retreatment may be necessary after an interval of 7-10 days if eggs survive (22),
- consideration of pillow protection and vinyl-type rather than cloth upholstery for chairs in communal areas, e.g. psychiatry units, emergency and physiotherapy departments and community health centers,
- need to return for re-evaluation prior to return to work,
- need to teach children not to share hats, headphones, combs, brushes, hair accessories.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Pediculosis

OH should refer to Section A – IV to develop an evaluation program specific to pediculosis.

AIII

PERTUSSIS (Whooping Cough)

1. Risk Assessment for Transmission of Pertussis to HCWs

1.1 Clinical Significance of Pertussis

Pertussis (whooping cough) is a highly communicable infection of the respiratory tract caused by *Bordatella pertussis*. Pertussis can affect individuals of any age; severity is greatest in young infants (190).

Pertussis in young infants may be complicated by pneumonia, seizures and encephalopathy. The mortality rate in children less than one month of age is 1-2 percent (21).

Parapertussis (caused by *Bordatella parapertussis*) is a similar but usually milder disease. Differentiation between the two is based on culture of the organism(22).

1.2 Evidence of Exposure/Transmission of Pertussis

The incidence of pertussis in Canada over the past 40 years has decreased by over 90% through immunization. The annual number of reported cases has ranged from 1,000 to 10,000 cases over the past 10 years. Reporting may be incomplete(190).

Most adults are susceptible to pertussis because immunization-induced immunity from the older vaccine disappears within 12 years after the last immunization (191).

Cases and outbreaks continue to occur in Canada because of incomplete immunization coverage, the need for multiple doses of vaccine to achieve protection, less than 100% efficacy of vaccine, waning vaccine induced immunity in those greater than 6 years of age, and continued circulation of the organism (192).

Acellular pertussis vaccines have better safety and efficacy profiles than whole cell vaccines; whole cell vaccines are no longer recommended in Canada (5).

Currently there is insufficient data to recommend acellular pertussis vaccine for adults. In the future, booster doses with the new acellular vaccine might represent the safest, least expensive strategy to reduce pertussis reservoirs among susceptible adults who work closely with children in hospitals (5,193,194).

1.3 Evidence of Occupational Transmission of Pertussis

Health care facilities have reported large outbreaks of pertussis. The reasons are multifactorial including, failure to recognize and isolate infected infants and children, lack of highly sensitive rapid diagnostic tools, failure to appreciate that immunity following immunization wanes with time, failure to diagnose, failure to institute control measures rapidly and failure to recognize and treat disease in HCWs (195).

Transmission to HCWs whose immunization has waned has been reported, (196,197) and

transmission has occurred because HCWs were reported to be unlikely to consider a diagnosis of pertussis in adults with paroxysmal cough (197).

HCWs may be exposed to and infected with pertussis much more frequently than reported as demonstrated by serological studies (193,196,198,199).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for pertussis.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Pertussis

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Pertusssis

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Pertussis

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Pertussis

OH should document the immune status of HCW at preplacement exam (5,192,195).

AII

OH should consider all HCWs to be susceptible to pertussis since immunity wanes and there are no recommended boosters for adults (191,192).

AII

There are no recommendations for immunization with whole cell vaccine for persons older than 7 years of age because adverse reactions may be more common and disease is typically less severe than in young children. Study of the new acellular vaccine regarding safety, immunogenicity and efficacy in adults is in progress. Although acellular vaccine is now licensed for adults and can be used instead of tetanus-diphtheria (Td) vaccine in adults who have to be protected against diphtheria and tetanus, safety data is lacking for more than one dose so there is no recommendation for use. Until the use in adults is clarified and guidelines are published there is no recommendation for immunization of adults with acellular vaccine for universal use or as part of tetanus-diphtheria boosters (5,194).

CIII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Pertussis

OH should advise HCWs to wear a surgical/procedure mask when within one metre of a patient

on Droplet Precautions for suspected or confirmed pertussis(1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Pertussis

2.2.1 Assessment of HCW Exposure to Pertussis

2.2.1.1 Method of Transmission of Pertussis

Pertussis is transmitted by droplet contact of the oral, nasal or conjunctival mucous membrane with the respiratory secretions from an infected individual.

2.2.1.2 Definition of Occupational Exposure to Pertussis

OH should define HCW exposure as face-to-face contact greater than 5 minutes with an infectious individual or sharing the same confined air space, i.e being within one metre of an infectious individual for greater than 1 hour (192).

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 6-20 days (1), usually 7-10 days (21). The period of communicability is from 1-2 weeks before the onset of paroxysmal cough until 3 weeks after the onset of cough if not treated, or 5 days after initiation of effective antibiotic therapy (1,195).

2.2.3 Criteria to Confirm the Diagnosis of Pertussis

Clinical illness – respiratory tract symptoms progressing to severe paroxysms of cough often with a characteristic respiratory whoop followed by vomiting; apnea and absence of whoop is common in infants.

Plus laboratory evidence – bacterial culture of nasopharynx positive for *Bordatella pertussis*; polymerase chain reaction (PCR) assay of nasopharyngeal specimen positive for *Bordatella pertussis.*

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Pertussis

2.2.4.1 HCW Exposed to Pertussis

OH should consider all HCWs to be susceptible to pertussis because immunity wanes and there

are no recommended boosters for adults (191,192).

AII

OH should refer exposed HCWs for clinical management that should include laboratory investigation and chemoprophylaxis (192,195).

AII

OH should not impose work restrictions on exposed HCWs who are taking prophylactic antibiotics(50,101,192,195).

AIII

OH should exclude exposed HCWs from work who refuse or are unable to take prophylaxis until the end of the incubation period, i.e 14 days from the last exposure if the HCW remains asymptomatic (192).

AIII

OH should consider discontinuing prophylactic antibiotics for exposed HCW if the source culture results are negative for *B. pertussis* and the clinical course is no longer suggestive of pertussis.

BIII

2.2.4.2 HCW Symptomatic or Infected with Pertussis

OH should refer HCWs who are symptomatic/infected with pertussis for confirmation of diagnosis and for clinical management that should include laboratory investigation and antibiotic therapy (195)**(Ref. ID 2)**

AIII

OH should exclude HCWs symptomatic/infected with pertussis until after 5 days of effective therapy (195)or from the beginning of the catarrhal stage through the 3rd week after the onset of paroxysms if untreated (1,192,195).

AII

OH should inform Infection Control as soon as possible of a suspected /confirmed case of pertussis.

AIII

2.2.4.3 OH Management of Pertussis Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria of diagnosis.

AIII

OH should liaise with Infection Control /Public Health authorities if an outbreak is suspected (192).

AIII

OH may modify work restrictions as necessary in outbreak situations.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Pertussis

OH should report case and suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Pertussis

OH should develop education specific to pertussis according to recommendations outlined in Section A – III and include information related to:

- waning immunity,
- the fact that pertussis can occur in adults and adults can transmit to infants,
- lack of a vaccine currently available for adults.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Pertussis.

OH should refer to Section A – IV to develop an evaluation program specific to pertussis.

AIII

RUBELLA

1. Risk Assessment for Transmission of Rubella to HCWs

1.1 Clinical Significance of Rubella

Rubella (German Measles) is an acute exanthamatous viral infection that affects children and adults (50) and may pose serious consequences to the fetus of a susceptible pregnant women.

Congenital rubella syndrome occurs in up to 90 percent of infants born to women who acquired rubella during the first trimester of pregnancy. Fetuses infected early are at greatest risk of intrauterine death, spontaneous abortion and congenital malformations of major organ systems (22).

1.2 Evidence of Exposure/Transmission of Rubella

Rubella outbreaks in health care facilities are of particular concern because of potential spread to susceptible pregnant women, both HCWs and patients (200).

Medical students have been found to be important sources in measles and rubella outbreaks (155).

Due to an increase of measles, mumps and rubella among United States adults, a study to determine antibody prevalence data among United States army recruits was completed. The authors reported as many as16-18 percent of young adults may be susceptible to measles, mumps and rubella (159). The opportunity to assure immunity to these viruses should not be overlooked (147).

1.3 Evidence of Occupational Transmission of Rubella

Transmission of rubella in health care facilities involving male or female HCWs and patients, (200-203)and, susceptible pregnant women (201,204-206)have been reported.

In one report, a nurse known to be susceptible was assigned to care for an infant infected with congenital rubella syndrome during a nursing shortage and developed clinical disease(203).

A male obstetrics-gynecology house officer infected with rubella exposed 170 personnel and 11 patients. His pre-employment history and physical was negative and there was no note of prior rubella infection or immunization. No rubella titre had been done (203).

Following a work related exposure, a nurse working in a hospital-based obstetric clinic was infected and exposed 151 patients and 44 HCWs to clinical disease (207).

A rubella outbreak involving HCWs exposed 200 pregnant women who were less than 16 weeks pregnant. HCWs experienced mild symptoms and continued to work while infectious resulting in a delay in diagnosis (204).

Finally, a hospital outbreak involving 47 HCWs with rubella resulted in the termination of one pregnancy and loss of 475 workdays (206).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I – IV is required in addition to the following specific recommendations for rubella.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Rubella

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Rubella

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Rubella

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Rubella

OH should document the HCW immune status at pre-placement exam (5).

AII

OH should consider HCWs to be immune to rubella with evidence of 1 dose of live rubella containing vaccine or documentation of rubella IgG(5).

AII

The National Advisory Committee on Immunization (NACI) recommends immunization *only* for female HCWs of childbearing age without documented immunity and susceptible HCWs of either sex who may through face-to-face contact expose pregnant women to rubella. *However*, all HCWs may expose and transmit rubella to pregnant females. *Therefore, irrespective of NACI* recommendations; OH should immunize all susceptible HCWs with a single dose of live rubella containing vaccine given as measles, mumps and rubella (MMR) vaccine unless there are contraindications(200-203,205,207).

AII

OH should not vaccinate susceptible female HCWs during pregnancy due to the theoretical risk of the rubella vaccine causing adverse consequences to the fetus (5). OH should offer vaccine post-partum if not provided by the physicians after delivery.

BIII

OH should advise female HCWs of child-bearing age to avoid pregnancy for one month after immunization (5).

AIII

OH should inform the non-immune HCW and his/her manager of the HCWs fitness to work with patients suspected or confirmed to have rubella.

AIII

OH should exclude non-immune HCWs from working with patients suspected or confirmed to have rubella (68,200).

AII

2.1.4 Personal Protective Equipment to Prevent HCW Exposure to or Infection with Rubella

OH should advise non-immune HCWs to not care for patients suspected or confirmed to have rubella; non-immune HCWs who must are advised to wear a surgical/procedure mask if within one metre of a patient on Droplet Precautions for suspected/confirmed rubella (1).

AII

OH should advise non-immune HCWs to not care for patients suspected or confirmed to have rubella; non-immune HCWs who must are advised to wear gloves to enter the single room or designated bedspace in a shared room of a patient on Contact Precautions for suspected or confirmed rubella and to wear a gown if contact with the individual or environmental surfaces is likely (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Rubella

2.2.1 Assessment of Health Care Worker Exposure to Rubella

2.2.1.1 Method of Transmission of Rubella

Rubella is transmitted by direct and droplet contact of the oral, nasal or conjunctival mucous membrane with respiratory secretions from an infected individual; direct and indirect contact of the oral, nasal or conjunctival mucous membrane with urine from an infant with congenital rubella syndrome.

2.2.1.2 Definition of Occupational Exposure to Rubella

OH should define HCW exposure to rubella as direct or droplet contact of the non-immune HCWs oral, nasal or conjunctival mucous membranes with infectious respiratory secretions during the period from 7 days before onset of symptoms to 7 days after symptoms appear.

AIII

OH should define HCW exposure to rubella associated with congenital rubella syndrome as a non-immune HCW having droplet, direct or indirect contact of oral, nasal or conjunctival mucous membranes with the nasopharyngeal secretions or urine of an infant with congenital rubella syndrome.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 14-21 days. The period of communicability is from 7 days before to 7 days after the onset of rash (1). Infants with congenital rubella may shed virus for months after birth (22).

2.2.3 Criteria to Confirm the Diagnosis of Rubella

Clinical illness – generalized erythematous, maculopapular rash, lymphadenopathy, slight fever, transient polyarthralgia, polyarthritis.

Plus laboratory evidence – IgM antibody positive for rubella; four-fold rise in rubella IgG antibody; viral culture of an appropriate clinical specimen positive for rubella.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Rubella

2.2.4.1 HCW Exposed to Rubella

OH should determine the immune status of the exposed HCW. If unknown or uncertain, test for IgG antibody.

AIII

OH should consider HCWs to be immune to rubella with evidence of one dose of live rubella-containing vaccine or documentation of rubella IgG(5).

AIII

OH should refer exposed non-immune HCWs for clinical management that should include:

- immunization if exposure did not result in infection to protect from future exposures. Live virus vaccine given after exposure does not prevent illness (5),
- administering Immune Globulin to exposed HCWs within 48 hours of exposure to attempt to modify or suppress symptoms even though Immune Globulin is not fully effective to prevent infection, including congenital infection (5).

AIII

OH should exclude non-immune exposed HCWs from work from the 7th day after their first exposure through the 21st day after their last exposure(1).

AIII

OH should refer non-immune exposed HCWs who are pregnant to their physicians for clinical management.

BIII

2.2.4.2 HCW Symptomatic/Infected with Rubella

OH should refer HCWs symptomatic/infected with rubella for confirmation of diagnosis and for clinical management that should include laboratory investigation and management of complications, e.g. arthritis.

AIII

OH should exclude HCWs symptomatic/infected with rubella from work until 7 days after the onset of rash (1).

AIII

OH should inform Infection Control as soon as possible of a case of rubella.

AIII

2.2.4.3 OH Management of Rubella Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control and Public Health if an outbreak is suspected.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Rubella

OH should report case or suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Rubella

OH should design education specific to rubella according to recommendations outlined in Section A – III and that vaccine should not be administered during or until one month after pregnancy.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Rubella

OH should refer to Section A – IV to develop an evaluation program specific to rubella

AIII

SCABIES (*Typical* and *Norwegian)*

1. Risk Assessment for Transmission of Scabies to HCWs

1.1 Clinical Significance of Scabies

Scabies is a pruritic skin disease caused by infestation with the mite *Sarcoptes scabiei* subspecies hominis (21).

Norwegian scabies also known as crusted or keratotic scabies, is an uncommon form of infestation characterized by intense infestation and widespread crusted hyperkeratotic lesions. It usually occurs in debilitated, developmentally disabled, or immunologically impaired persons (21,208). When transmitted to HCWs it manifests as *typical* scabies (208,209).

1.2 Evidence of Exposure/Transmission of Scabies

The risk of a scabies epidemic is much higher when the index case has *Norwegian* scabies in contrast with *typical* cases. Patients with *Norwegian* scabies have hundreds of thousands of mites compared to those with *typical* scabies where there are about 20 - 50 mites per individual (208-211).

Minimal contact with *Norwegian* scabies can result in transmission because of the large number of mites in the exfoliating skin scales (21).

Norwegian or *typical* scabies can be transmitted as long as the patient remains infested and untreated, including the interval before symptoms develop (21).

Outbreak recognition may be delayed by the four to six week incubation period. During the incubation period asymptomatic case contacts may be actively and unknowingly transmitting mites (188).

Additional exposure and increased transmission has been reported to be as a result of misdiagnosis and therapeutic delay (188,210,212).

1.3 Evidence of Occupational Transmission

Outbreaks of scabies (*typical* and *Norwegian*) affecting HCWs have been reported in hospitals, extended care, and Long Term Care facilities (211-218).

A hospital outbreak traced to a case of *Norwegian* scabies resulted in symptomatic cases in 45 staff and 32 patients. Over 500 staff and 228 asymptomatic inpatient contacts required prophylaxis. Recurrences occurred in seven HCWs due variously to re-exposure to infected patients (3) or affected family members (2), incomplete treatment (1) and incorrect application of medication (1). It took four months to contain the outbreak (215).

A sustained outbreak of *Norwegian* scabies from an index case at an extended-care setting resulted in the infestation of 49 percent of the nurses (27/55). Individuals may harbor mites in

their skin for several days before onset of symptoms and this occult carriage plays a role in scabies transmission (212).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for typical or Norwegian scabies.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Scabies

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Scabies

Administration should ensure there is consideration for plastic covered pillows and protected chairs in areas with communal use, i.e. psychiatry units, community health centers, physiotherapy and emergency departments.

BIII

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Scabies

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent Exposure to or Infection with Scabies

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a patient on Contact Precautions for suspected or confirmed *Norwegian* scabies and to wear a gown if contact with the patient or environment is likely (1).

AII

OH should advise HCWs to wear gloves and a gown when providing direct care to a patient suspected or confirmed to have *typical* scabies (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Scabies

2.2.1 Assessment of HCW Exposure to Scabies

2.2.1.1 Method of Transmission of Scabies

Typical/Norwegian scabies is transmitted by direct skin to skin contact with an infested individual; occasionally through contact with clothing/bedding of an infested individual but not

usually items such as furniture though more likely with *Norwegian* scabies.

2.2.1.2 Definition of Occupational Exposure to Scabies

OH should define HCW exposure to *typical* scabies as direct skin-to-skin contact with an infested patient before treatment or until 24 hours of effective treatment.

AIII

OH should define HCW exposure to *Norwegian* scabies as minimal direct or indirect contact with an infested person before treatment or until 24 hours of effective treatment. Only minimal contact is required because of the large number of mites present on the source.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis and the extent of infestation, i.e. *typical/Norwegian* scabies of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period in persons without previous infestation with scabies (*typical/Norwegian*) is usually 4-6 weeks. Those who have been previously sensitized to scabies develop symptoms 1-4 days after repeat exposure to the mite. (1). The period of communicability continues as long as the patient remains infested and untreated, including the interval before symptoms develop (21).

2.2.3 Criteria to Confirm the Diagnosis of Scabies

Clinical illness – erythematous, maculopapular skin eruption which is intensely itchy, particularly at night; thread-like burrow lines may be evident but are frequently obliterated by scratching, leaving the skin excoriated; crusted hyperkeratotic lesions characterize Norwegian scabies.

Skin scraping may be considered and should be performed by someone skilled in the procedure. Results are frequently negative despite strong clinical evidence of infestation.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Scabies

2.2.4.1 HCW Exposed to Scabies

OH should not routinely prophylax HCWs exposed to *typical* scabies when there is no evidence of transmission (188,215-217,219,220).

AII

OH should refer HCWs exposed to *Norwegian* scabies for clinical management that may include one or more applications of scabicide (21,188,211,212,215).

AII

OH should not to exclude HCWs exposed to *typical* scabies(50,188,217).

AIII

OH should exclude HCWs exposed to *Norwegian* scabies until HCW completes one application of effective treatment(21,50,212).

AII

2.2.4.2 HCW Symptomatic or Infested with Scabies

OH should refer HCWs who are symptomatic or infested with *typical* or *Norwegian* scabies for confirmation of diagnosis and for clinical management that should include provision of scabicide and may include skin scraping for diagnosis (21,50).

AIII

OH should exclude HCWs infested with *typical* scabies until the HCW completes one application of effective treatment(50,217) and they are clinically assessed prior to return to work.

AIII

OH should exclude HCWs infested with *Norwegian* scabies until after the HCW completes the last application of effective treatment and they are re-evaluated prior to return to work (215).

AIII

OH should advise HCWs that exposed household members and intimate contacts should seek medical evaluation from a public health nurse/community health centre or physicians regarding evaluation of risk, prophylaxis, diagnosis and or treatment (217).

AIII

OH should advise HCWs to return for re-evaluation prior to return to work.

AIII

2.2.4.3 OH Management of Scabies Outbreak

OH should investigate for the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should consider the likelihood of an outbreak when only one case of *Norwegian* scabies is identified (21,211,212,215).

AII

OH should consider broadening prophylaxis when transmission of *typical* scabies has occurred (216,217,221,222).

AII

OH should inform Infection Control as soon as possible when a case of suspected or confirmed *Norwegian or typical* scabies occurs.

AIII

OH should liaise with Infection Control and or Public Health if an outbreak is suspected.

AIII

OH and Infection Control should arrange for the concurrent prophylaxis and or treatment of staff and patients if a combined outbreak is declared (21,50,209,214,215).

AII

OH may modify work restrictions as necessary in outbreak situations.

BIII

2.2.4.4 OH Reporting to Public Health of HCW with Scabies

OH should report a suspected or confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Scabies

OH should design education specific to scabies according to recommendations outlined in Section A- III including:

- preventing transmission by maintaining a high index of suspicion, early recognition and diagnosis and adequate treatment of index case(s) (208),
- the difference between *typical* and *Norwegian* scabies,
- the method and risk of transmission, e.g. likelihood increases with *Norwegian* scabies because of the increased number of mites,
- the extended incubation period,
- the period of communicability and being infectious prior to the onset of symptoms (212,221),
- the need for ongoing self-evaluation and reporting to OH reinfestation or symptoms , e.g. rash or pruritis that intensifies at night,
- the importance of following product instructions for scabicide (222),
- the need for hot water washing/drycleaning or storing in a sealed plastic bag for 7 days any clothes or bedding used up to 4 days prior to treatment (21),
- the lack of need for environmental disinfection for typical scabies (21),
- the need to vacuum environmental surfaces in a room used by a patient with Norwegian scabies (21),
- importance of pillow protection in areas with communal use, e.g.physiotherapy, clinics,
- consideration of vinyl-type rather than cloth upholstery for chairs in selected areas, e.g. psychiatry, emergency, physiotherapy, community health centers,
- need for evaluation, prophylaxis and treatment of exposed household members and other intimate contacts (222),
- the need for re-evaluation prior to return to work,
- the caution regarding self diagnosis.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Scabies

OH should refer to Section A-IV to develop an evaluation program specific to scabies **AIII**

STAPHYLOCOCCUS AUREUS (S. AUREUS)

A. Methicillin Sensitive S. aureus (MSSA)

1. Risk Assessment for Transmission of MSSA to HCWs

1.1 Clinical Significance of MSSA

Staphylococcus aureus causes a wide range of infections from localized to invasive diseases. Localized diseases include wound infections, furuncles, and impetigo. Invasive infections include septicemia, osteomyelitis, arthritis, endocarditis, and pneumonia. S. aureus also causes toxin-mediated diseases, such as toxic shock syndrome, scalded skin syndrome and food poisoning (21).

1.2 Evidence of Exposure/Transmission of MSSA

S. aureus is ubiquitious and has many strains. Approximately 20-30 percent of the population are carriers of *S. aureus* as part of their normal flora and are colonized in the anterior nares. Persons with draining lesions or any purulent discharge are the most common cause of epidemic spread. The role of contaminated objects has been over emphasized; the hands are the most important instrument for spreading infection (22).

Nasal carriage among HCWs is an important hospital reservoir of *S. aureus*; about 25 percent of all hospital based HCWs are nasal carriers. The organism is easily transferred to the hands, increasing the potential for transmission (223).

Outbreaks caused by HCWs who are nasal carriers of *S. aureus* are relatively uncommon, but do occur (224).

The likelihood that a nasal carrier may cause an outbreak may increase if the carrier acquires the ability to disperse the organism into the air; the term "cloud babies" was introduced to describe this situation (225). Nasal carriers of *S. aureus* with concurrent viral upper respiratory tract infection have been shown to disperse *S. aureus* into the air and cause outbreaks (224-226).

HCWs who are infected or colonized with *S. aureus* can serve as reservoirs of the organism and have been implicated in transmission (224,226,227).

A neurosurgeon found to be a chronic nasal carrier of *S. aureus* was associated with two nosocomial cases of post-surgical toxic shock syndrome infections occurring four years apart. There was no mention whether the surgeon had a concurrent upper respiratory tract infection. Molecular epidemiology was performed to prove the relatedness of the strains (227).

Two different hospitals reported nursery outbreaks of staphylococcal skin disease and attributed the outbreaks to a nurse who worked at both hospital nurseries on alternate weeks and was a nasal carrier of an unusual strain of *S. aureus*. The outbreaks occurred while she experienced an upper respiratory tract illness making the authors hypothesize a situation analogous to the "cloud babies" described above (226)

Some resistant strains of *S. aureus* emerged after the use of oral and topical antimicrobial agents prescribed to eradicate carriage in colonized HCWs or patients (228-231). Recommendations now exist that these agents should only be used when a HCW is epidemiologically linked to transmission (232).

1.3 Evidence of Occupational Transmission of MSSA

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for S. aureus.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with MSSA

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with MSSA

See Section A: 2.1.1.

2.1.2 Administrative Controls

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with MSSA

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with MSSA

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a patient on Contact Precautions for suspected or confirmed MSSA and to wear a gown if contact with the patient or environmental surfaces is likely (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with MSSA

2.2.1 Assessment of HCW Exposure to MSSA

2.2.1.1 Method of Transmission of MSSA

MSSA is transmitted by direct or indirect contact of skin or mucous membrane from an individual with colonized or infected body sites, wound drainage or respiratory secretions primarily as a result of HCW hand contamination and subsequent self-inoculation of the nares or

transfer to individuals/environment.

2.2.1.2 Definition of Occupational Exposure to MSSA

OH should define HCW exposure as direct or indirect contact of non-intact skin or mucous membranes with MSSA infected body sites, wound drainage or respiratory secretions.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period varies according to clinical presentation, host immune status and use of effective antibiotic therapy. Communicability is as long as purulent lesions continue to drain or the carrier state persists (22).

2.2.3 Criteria to Confirm the Diagnosis of MSSA

Clinical illness – localized furuncle, impetigo, wound infection, septicemia, osteomyelitis, arthritis, endocarditis, pneumonia, toxic-shock syndrome, scalded-skin syndrome or food poisoning.

Plus laboratory evidence – bacterial culture of appropriate clinical specimen positive for methicillin sensitive *Staphylococcus aureus.*

Or clinical illness in a HCWwho is epidemiologically linked to a case.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with MSSA

2.2.4.1 HCW Exposed to MSSA

OH should not routinely culture HCWs exposed to MSSA.

AII

There are no modifications to work practices or work restrictions for HCWs exposed to MSSA.

2.2.4.2 HCW Colonized/Symptomatic/Infected with MSSA

OH should only refer colonized HCWs for clinical management if epidemiologically linked to transmission.

AII

There are no modifications to work practices or work restrictions for HCWs colonized with

MSSA if not linked epidemiologically to transmission.

AII

OH should evaluate HCWs with signs and symptoms of infection, e.g. carbuncle, furnucle, and refer for clinical management as necessary.

AIII

OH should refer HCWs with clinically significant MSSA infection for confirmation of diagnosis and for clinical management that may include laboratory investigation and antibiotic therapy.

AIII

OH should exclude HCWs with skin lesions on hands that are suspected or known to be caused by MSSA, i.e. carbuncle, furuncle until lesions are resolved and HCW assessed for fitness for work.

AIII

OH should exclude HCWs with lesions on sites other than on their hands suspected or confirmed to be caused by MSSA from contact with patients and their environment until either their lesions can effectively be covered by dressings and clothing and hygiene or handwashing is not compromised or until lesions are healed.

AIII

2.2.4.3 OH Management of MSSA Outbreak

OH should investigate the possibility of an outbreak if more than 1 HCW or patient from the same unit meets the criteria of diagnosis and appears to be linked epidemiologically.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected.

AIII

OH should ensure cultures (nose, throat, skin lesions) of HCWs epidemiologically linked to clinically significant nosocomial MSSA case(s) in patients.

AIII

OH should refer HCWs colonized with MSSA and epidemiologically linked to patient transmission for medical assessment that should include laboratory investigation with molecular typing and therapy for decolonization(226,233,234).

AII

OH should exclude HCWs colonized with MSSA if proven to be epidemiologically linked to patient transmission until antibiotic therapy is complete, medical assessment is complete and appropriate control measures/ and or work restrictions are determined (226,233,234).

AII

OH should assess HCWs colonized with MSSA and epidemiologically linked to transmission for

fitness for work; assess type of patient/physical setting/work, hygiene practices, what risk control measures can be utilized and follow-up procedures.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with MSSA

There are no requirements to report a single case; OH should report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with MSSA

OH should design education specific to MSSA according to recommendations outlined in Section A - III and about:

- difference between methicillin sensitive S. aureus (MSSA) and methicillin resistant S. aureus (MRSA),
- meaning of colonization /infection,
- possibility of intermittent/prolonged shedding,
- cultures only recommended for HCWs linked to transmission,
- decolonization therapy only considered when linked to transmission,
- role of contaminated hands and dermatitis/lesions of HCWs in transmission.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with MSSA

OH should refer to Section A - IV to develop an evaluation program specific to MSSA.

AIII

B. Methicillin Resistant S. aureus (MRSA)

1. Risk Assessment for Transmission of MRSA to HCWs

1.1 Clinical Significance of MRSA

Methicillin resistance in *S. aureus* rapidly developed after the introduction of methicillin. The subsequent spread of organisms resistant to methicillin and related antibiotics throughout the world created a myriad of problems related to therapeutic choices and patient management including isolation (235).

MRSA are capable of causing the same infections as methicillin sensitive strains of *S. aureus*. Such infections include; bacteremias, infections involving post-operative burns and wounds, intravascular cannula-related infections, pneumonias and omphalitis (236).

Morbidity and mortality associated with nosocomial MRSA infections are comparable with those seen with susceptible strains of *S. aureus* (237,238).

1.2 Evidence of Exposure/Transmission of MRSA

MRSA outbreaks/infections usually occur more often in elderly or immuno-compromised patients or among patients with severe chronic medical conditions (236,237,239).

Most published literature regards colonized patients as the major reservoir for MRSA and that transmission occurs via the hands of HCWs (240).

The increase in community-acquired MRSA may be the result of transmission from persons who acquired MRSA while in the hospital (21).

The Canadian Hospital Epidemiology Committee (CHEC) initiated national surveillance for MRSA in 1995. Twenty-three sentinel hospitals across the country participate. During the first four years of surveillance a total of 2,450 new cases were reported from 22 hospital sites, for a mean rate of 2.4/100 *S. aureus* isolates (range: 0.1-19.0) This rate represents an increase in each year studied from 0.9% in 1995, to 1.7% (1996), 2.6% (1997), and 3.9% (1998) (241).

Four epidemic strains have emerged through molecular analysis of the Canadian MRSA isolates identified since1995. The epidemic strains may possess additional virulence factors contributing to their persistence and transmission in hospitals across Canada (242).

The economic impact of MRSA to Canadian hospitals has been estimated to be $33M-$42M(CDN) annually and rising with the increasing incidence of MRSA (243).

1.3 Evidence of Occupational Transmission of MRSA

Transmission of MRSA in hospitals occurs primarily on the hands of HCWs that are contaminated through contact with colonized or infected body sites of patients (232,235,237-239).

Nasal carriers of MRSA have been shown to carry the same strain on their hands emphasizing the importance of handwashing between caring for patients to prevent transmission (223).

In two hospitals (a 642-bed medical-surgical facility with both acute and long-term care divisions and a 707-bed psychiatric facility) five employees were diagnosed with MRSA soft tissue infections. Four of the five employees presented to the Employee Health Service and the fifth reported to the Infectious Disease Clinic. All employees had direct exposure to patients colonized with MRSA. In the conclusion of this case-series study the authors noted that HCWs in hospitals with endemic MRSA may acquire MRSA infection (244).

The use of epidemiological principles identified a HCW with chronic MRSA sinusitis and led to detection and control of a hospital-wide outbreak of MRSA. The outbreak was controlled without extensive culturing of personnel or environmental surfaces and without routine administration of decolonization regimens (245).

It has been suggested that know *S. aureus* shedders should wear a mask when they are experiencing a upper respiratory infection as a method to minimize the spread of *S. aureus* to patients (224).

Recommendations

Compliance with the recommendation for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for MRSA.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with MRSA

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with MRSA

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with MRSA

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with MRSA

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with MRSA

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a patient on Contact Precautions for suspected or confirmed MRSA and to wear a

gown if contact with the patient or environmental surfaces is likely (1).

AII

OH should advise HCWs to consider wearing a surgical/procedure mask when providing direct care for a patient known to have MRSA nasal or respiratory colonization and has a superimposed respiratory infection(1).

AII

OH should advise HCW known to be a MRSA carrier to wear a surgical/procedure mask when the HCW has an upper respiratory tract infection (224).

BIII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with MRSA

2.2.1 Assessment of HCW Exposure to MRSA

2.2.1.1 Method of Transmission of MRSA

MRSA is transmitted by direct or indirect contact of skin or mucous membranes from an individual with MRSA colonized or infected body sites, wound drainage or respiratory secretions primarily as a result of HCW hand contamination and subsequent self-inoculation of the nares or transfer to individuals/environment.

2.2.1.2 Definition of Occupational Exposure to MRSA

OH should define HCW exposure as direct or indirect contact of non-intact skin or mucous membranes with MRSA colonized or infected body sites, wound drainage or respiratory secretions.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period varies widely according to clinical presentation, host immune status and use of effective antibiotic therapy. Communicability is as long as purulent lesions drain or the carrier state persists (22).

2.2.3 Criteria to Confirm the Diagnosis of MRSA

Clinical illness – localized furuncle, impetigo, wound infection; septicemia, osteomyelitis, arthritis, endocarditis, pneumonia, toxic-shock syndrome, scalded-skin syndrome or food poisoning.

OR colonization

Plus laboratory evidence – bacterial culture of appropriate clinical specimen positive for methicillin resistant *Staphylococcus aureus.*

Or clinical illness or colonization in a HCW who is epidemiologically linked to a case.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with MRSA

2.2.4.1 HCW Exposed to MRSA

OH should not routinely culture HCWs exposed to MRSA.

AII

There are no modifications to work practices or work restrictions for HCWs exposed to MRSA.

2.2.4.2 HCW Colonized/Symptomatic/Infected with MRSA

OH should refer MRSA colonized/symptomatic/infected HCWs for confirmation of diagnosis and for clinical management that should include laboratory investigation with molecular typing and antibiotic therapy for decolonization and/or treatment(236,237,244,245).

AIII

OH should exclude HCWs colonized with MRSA until medical assessment is complete, decolonization therapy is complete and appropriate control measures that may include periodic screening and or work restrictions are determined (232,246).

AIII

OH should exclude HCWs with symptoms/infections that are suspected or known to be caused by MRSA (carbuncle, furuncle) until antibiotic therapy for treatment and decolonization is complete, lesions are resolved, medical assesssment is complete and appropriate control measures and/or work restrictions are determined (232).

AII

OH should assess HCWs colonized/symptomatic/infected with MRSA for fitness for work; assess type of patient/physical setting/work, hygiene practices, what risk control measures can be utilized and follow-up procedures.

BIII

2.2.4.3 OH Management of MRSA Outbreak

OH should obtain cultures of HCWs only when they have been epidemiologically linked to transmission (224,232,235,237,245)

OH should investigate the possibility of an outbreak if more than 1 HCW or patient from the same unit meets the criteria for diagnosis (246).

BII

OH should liaise with Infection Control/Public Health if an outbreak is suspected (240,246).

BII

OH should refer HCWs colonized with MRSA and epidemiologically linked to patient transmission for medical assessment that should include laboratory investigation with molecular typing and antibiotic therapy for decolonization (224,232,235-237,245).

AII

OH should exclude HCWs colonized with MRSA if proven to be epidemiologically linked to patient transmission until antibiotic therapy is complete, medical assessment is complete and appropriate control measures and/or work restrictions are determined (232).

AII

OH should assess HCWs colonized with MRSA and epidemiologically linked to patient transmission for fitness for work; assess type of patient.physical setting/work, hygiene practices, what risk control measures can be utilized and follow-up procedures.

AIII

OH should inform Infection Control/Public Health as soon as possible of a HCW who is colonized or infected.

AIII

OH may modify work practices during an outbreak, e.g. assigning HCW known to have the strain to patients with the same strain.

BIII

2.2.4.4 OH Reporting to Public Health of HCW with MRSA

OH should report case and suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to Infection with MRSA

OH should design education specific to MRSA according to recommendations outlined in Section A - III and about:

- difference between methicillin sensitive *S. aureus* (MSSA) and methicillin resistant *S. aureus* (MRSA),
- meaning of colonization/infection,
- possibility of intermittent/prolonged shedding,
- factors that increase transmission i.e., respiratory tract infections/lesions(224,236),
- prevention of transmission, i.e. use of masks when MRSA positive HCW has a respiratory infection; reassignment (224),
- why risk is primarily to patients, not HCWs,
- role of dermatitis /lesions or contaminated hands in transmission,

- need to report to OH if HCW has draining lesions, dermatitis; or if symptoms recur,
- fact that cultures are recommended only when linked to transmission,
- decolonization therapy may be considered when epidemiologically linked to transmission.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with MRSA

OH should refer to Section A – IV to develop an evaluation program specific to MRSA.

AIII

STREPTOCOCCUS, GROUP A (GAS)

1. Risk Assessment for Transmission of GAS

1.1 Clinical Significance of GAS

Group A (beta hemolytic) streptococcus (GAS) causes a wide range of infections from localized to invasive diseases. The most common clinical illnesses are respiratory and skin/soft tissue infections. GAS can, however cause severe invasive disease including necrotizing fasciitis and toxic shock syndrome.

1.2 Evidence of Exposure/Transmission of GAS

Since the late 1980s there has been a resurgence of GAS infection presenting as toxic shock syndrome, necrotizing fasciitis or myositis (247-249).

Some investigators suggest the increase is due to the emergence of a highly virulent clone of a specific strain (248) while others suggest it is host factors that determine the severity of infection (249).

A recent prospective population-based Ontario surveillance study reported the incidence of invasive GAS disease to be 1.5 cases per 100,000 population per year. The authors concluded that patients at greatest risk for invasive GAS disease, including toxic shock syndrome and necrotizing fasciitis, are the elderly and those with underlying medical conditions. There is some risk of transmission of invasive disease in households and healthcare institutions (250).

The transmission of GAS in hospitals can be prevented by improving infection-control practices or identifying and treating staff members who are symptomatic (251-255).

1.3 Evidence of Occupational Transmission of GAS

Outbreaks involving a variety of patient groups, (e.g. postpartum women and newborns, post-operative surgical patients, burn patients, and patients in geriatric wards or extended care facilities) have been reported (256).

Healthcare providers have been epidemiologically or microbiologically linked as the source to the index case (251-253,257-264). HCWs were typically asymptomatic (251,254,257,258,261-265). The pharynx, vagina, rectum or skin of HCWs were found to be sites of colonization or infection. The source of infection for some HCWs may have been family members (252,254,260,261,266,267).

Active surveillance during outbreaks has often identified additional personnel colonized by the epidemic strain and HCWs with clinical infections as secondary cases (252,255,256,268).

Formal case-control studies and review of common hospital contacts of infected patients have been useful in identifying HCWs as possible index cases. Typing of the epidemic streptococcal strain has been a widely used research tool to investigate the extent of the outbreak and to aid in

determining whether a colonized HCW is the index case (256).

Several investigators have demonstrated that rectal or vaginal carriage by HCWs can lead to GAS in the air when changing clothes or exercising (251,260,262,265).

HCWs who perform surgery with rectal or vaginal carriage of GAS may have transient scalp colonization resulting in contamination of wound sites during surgery. Infected skin sites have also been suspected of direct transmission (253,266).

One study using molecular and serotyping procedures reported that three HCWs developed symptomatic GAS infection following exposure to patients with invasive disease. The authors concluded that close contact with invasive GAS places HCWs at risk when exposed to secretions from infected patients (247).

Transmission of GAS between patients and HCWs in nursing homes has also been suggested (255,269).

Although some jurisdictions recommend and offer prophylaxis for "close contacts" of GAS associated necrotizing fasciitis, toxic shock syndrome, meningitis, pneumonia or any form of GAS that results in death, (270,271), the most effective approach to management of contacts remains controversial (250).

Recommendations

Compliance with the recommendation for the components of an OH program outlined in Section A, I-IV is required in addition to the following recommendations for GAS.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with GAS

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with GAS

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with GAS

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with GAS

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with GAS

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a

shared room of a patient on Contact Precautions for suspected or confirmed major skin/soft tissue infection with GAS; and to wear a gown when contact with the patient or environmental surfaces is likely (1).

AII

OH should advise HCWs to wear a surgical/procedure mask if within one metre of a pediatric patient on Droplet Precautions for suspected or confirmed GAS pneumonia, pharyngitis or scarlet fever.

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with GAS

2.2.1 Assessment of HCW Exposure to GAS

2.2.1.1 Method of Transmission of GAS

GAS is transmitted by droplet, direct or indirect contact of the oral, nasal, or conjunctival mucous membranes with infectious respiratory or wound secretions; by direct contact of non-intact skin with infectious respiratory or wound secretions.

2.2.1.2 Definition of Occupational Exposure to GAS

OH should define HCW exposure as droplet, direct or indirect contact of oral, nasal or conjunctival mucous membrane or as direct contact of non-intact skin with infectious respiratory or wound secretions from individuals with necrotizing fasciitis, toxic shock syndrome, meningitis, pneumonia or any form of GAS that results in death within 7 days prior to the onset of GAS and until 24 hours of effective antibiotic therapy.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is variable by clinical syndrome, usually 1-3 days. The period of communicability is until 24 hours of effective antibiotic treatment completed.

2.2.3 Criteria to Confirm the Diagnosis of GAS

Clinical illness – pharyngitis, scarlet fever, skin/soft tissue infection, myositis, endometritis, bacteremia, meningitis, necrotizing fasciitis or toxic shock syndrome.

Plus laboratory evidence – antigen detection assay-positive for group A Streptococcus; bacterial culture of appropriate clinical specimen positive for group A Streptococcus.

OR colonization in an individual who is epidemiologically linked to a case within the appropriate incubation time.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with GAS

2.2.4.1 HCW Exposed to GAS

OH should not routinely culture HCWs exposed to GAS.

OH should refer HCWs exposed to GAS necrotizing fasciitis, toxic shock syndrome, meningitis, or an invasive GAS case that resulted in death, for clinical management that may include laboratory investigation and prophylaxis (250) as recommended by Provincial guidelines (270,271).

AII

There are no modifications to work practices or work restrictions for HCWs exposed to GAS.

2.2.4.2 HCW Symptomatic/Colonized/Infected with GAS

OH should only refer colonized HCWs for clinical management if epidemiologically linked to transmission.

AIII

There are no modifications to work practices or work restrictions for HCWs colonized with GAS if not linked epidemiologically to transmission.

AIII

OH should evaluate HCWs with signs/symptoms of GAS infection, e.g. rash, sore throat, and refer for clinical management as necessary.

AIII

OH should refer HCWs with clinically significant GAS infection for confirmation of diagnosis and for clinical management that should include laboratory investigation and antibiotic therapy (256,270,271).

AIII

OH should exclude HCWs with clinically significant GAS infection until 24 hours of effective antibiotic therapy is completed (1,256,270,271).

AII

OH should inform Infection Control as soon as possible if a case of GAS necrotizing fasciitis, toxic shock syndrome, meningitis, or an invasive GAS case that results in death is suspected or confirmed.

AIII

2.2.4.3 OH Management of GAS Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meet the criteria for diagnosis and appears to be linked epidemiologically to transmission.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected or confirmed.

AIII

OH should ensure cultures (throat, rectal, vaginal and skin lesions) of HCWs epidemiologically linked to clinically significant nosocomial GAS case(s) in patients e.g surgical wounds, endometritis, cellulitus, necrotizing fasciitis, toxic shock syndrome (68,207,252,253,256,260,266,272,273).

AII

OH should refer HCWs colonized with GAS and epidemiologically linked to patient transmission for medical assessment that should include laboratory investigation with serotyping and antibiotic therapy (253,256,260,262,266,272,273).

AII

OH should exclude HCWs colonized/symptomatic/infected with GAS if proven to be epidemiologically linked to transmission until 24 hours of effective antibiotic therapy, medical assessment is complete and appropriate control measures and/or work restrictions are determined *(68,256,260,272,273)*.

AII

OH should assess HCWs colonized/symptomatic/infected and epidemiologically linked to transmission for fitness to work; assess type of patient/physical setting/work, hygiene practices, what control measures can be utilized and follow-up schedule is established.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with GAS

OH should report case of GAS necrotizing fasciitis or toxic shock syndrome or suspected/confirmed outbreak of GAS to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with GAS

OH should design education specific to GAS according to recommendations outlined in Section A – III and including:

- cultures are only obtained if HCW epidemiologically linked,
- prophylaxis is contraversial and may/may not be offered to HCWs exposed to serious disease according to Provincial policy,
- differences of clinical manifestations and severity of illness,

- reporting illness to OH (273),
- reporting similar symptoms in family members (247,252,254),
- recommending symptomatic family members seek medical evaluation.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with GAS

OH should refer to Section A - IV to develop an evaluation program specific to GAS.

AIII

TINEA (Ringworm)

1. Risk Assessment for Transmission of Tinea to HCWs

1.1 Clinical Significance of Tinea

Tinea is a fungal disease of the skin (*Tinea corporis*), scalp (*T. capitis*) and feet. (*T. pedis*) (22). *Trichophyton tonsurans* is the most common cause of tinea capitis (274).

The infection can be confused with many diseases and the fungus can remain viable on contaminated items or surfaces thus providing reservoirs for transmission (21).

1.2 Evidence of Exposure/Transmission of Tinea

1.3 Evidence of Occupational Transmission of Tinea

The minimal incubation period of tinea corporis to be 5-7 weeks but may be longer (275).

A three-year retrospective review of mycology data from a long-stay ward that experienced *T. tonsurans* infections over a nine-year period identified 33 mycology samples from 9 patients, 3 staff and one child of an affected staff member. The authors concluded it is important to examine all staff and patients in institutional outbreaks even in the absence of clinical disease, and to perform appropriate mycological testing (274).

In an outbreak of tinea corporis, nine of thirty, (30%) HCWs were infected. The outbreak was traced to a patient whose tinea infection had gone undiagnosed for five weeks. Seven of the nine HCWs provided direct care to the index patient and the remaining two had indirect contact handling soiled linen (276).

Thirteen of 22 HCWs on a pediatric ward with frequent unprotected contact with a child with undiagnosed scalp lesions developed tinea corporis. Most HCWs were able to cover their lesions while at work; one HCW with extensive lesions was excluded from work for 14 days (277).

In another study, despite early diagnosis and treatment of a child infected with tinea corporis, the infection was transmitted to four HCWs. HCW lesions involved unprotected skin that had been in direct physical contact with the index case (275).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for tinea.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Tinea

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Tinea

See Section A: 2.1.1.

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Tinea

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Tinea

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Tinea

See Section A: 2.1.4.

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Tinea

2.2.1 Assessment of HCW Exposure to Tinea

2.2.1.1 Method of Tinea Transmission

Tinea is transmitted through direct or indirect skin contact with scalp or skin lesions of an infectious individual or animal or contaminated environment.

2.2.1.2 Definition of Occupational Exposure to Tinea

OH should define HCW exposure as direct or indirect skin contact with infectious skin or scalp lesions or contaminated environmental surfaces.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of the HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is unknown. The period of communicability is for as long as lesions are present (1) or viable fungus persists on contaminated environmental surfaces (22).

2.2.3 Criteria to Confirm the Diagnosis of Tinea

Clinical illness - skin lesions of feet, body or head frequently well demarcated, itchy, pustular, scaly and may involve hair loss.

Plus laboratory evidence – microscopic examination of skin scrapings or hair positive for tinea; culture of skin scrapings or hair.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Tinea

2.2.4.1 HCW Exposed to Tinea

There are no modifications to work practices or work exclusions for HCWs exposed to tinea.

AIII

2.2.4.2 HCW Symptomatic/Infected with Tinea

OH should refer HCWs symptomatic/infected with tinea for confirmation of diagnosis and for clinical management that may include laboratory investigation and treatment.

AIII

OH should instruct HCWs with tinea to cover lesions with occlusive dressings while at work and reinforce handwashing (275-277).

AIII

OH should reassign HCWs with tinea to non patient care duty when lesions cannot be covered or are present on hands or forearms and handwashing is compromised (277).

AIII

2.2.4.3 OH Management of Tinea Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meet the criteria for diagnosis.

AIII

OH should liaise with Infection Control and Public Health if an outbreak is confirmed/suspected.

AIII

OH should consider the examination of all staff during institutional outbreaks even in the absence of clinical disease and perform appropriate mycological testing (274).

BIII

2.2.4.4 OH Reporting to Public Health of HCW with Tinea

There is no reporting requirement for a single case; OH should report suspected or confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure of Infection with Tinea

OH should design education specific to tinea according to the recommendations outlined in

Section A – III and to disinfect contaminated environmental surfaces with an approved hospital disinfectant (22).

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Tinea

OH should refer to Section A - IV to develop an evaluation program specific to tinea.

AIII

TUBERCULOSIS (TB)

Administration should ensure OH develops policies and procedures for the prevention and management of HCW exposure and or infection with TB according to Health Canada *Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings (1996)* (12), *A National Consensus on Guidelines for Establishment of a Post-Exposure Notification Protocol for Emergency Responders* (13), *Canadian Tuberculosis Standards* – Fourth Edition (73,278), (74), (75), and related provincial recommendations.

TYPHOID FEVER (SALMONELLA TYPHI/ENTERIC FEVER)

Note: Please refer to the section on gastroenteric infections in Part II, page __ for recommendations on salmonella infections other than *S. typhi*.

1. Risk Assessment for Transmission of *S. typhi* to HCWs

1.1 Clinical Significance of *S. typhi*

Typhoid (enteric) fever is caused primarily by *Salmonella typhi* (22). It is a systemic disease characterized by fever, constitutional symptoms, splenomegaly, abdominal pain, and is associated with foreign travel.

About 10 percent of untreated typhoid fever patients will continue to have fecal colonization with the organism at three months after the onset of symptoms, and 2-5 percent become permanent fecal carriers (22).

1.2 Evidence of Exposure/Transmission of *S. typhi*

Cases of typhoid fever in the US are usually acquired during foreign travel, or by consumption of food contaminated by a chronic carrier (21).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following recommendations specific to S. typhi.

2. Risk Control Measures

2.1 Risk Control Measures to prevent HCW Exposure to or Infection with *S. typhi*

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with *S. typhi*

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with *S. typhi*

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with *S. typhi*

There are no recommendations for routine immunization (5).

AIII

OH should consider immunization of laboratory workers in specialized reference or research facilities who frequently handle cultures of S. typhi (5).

AII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with *S. typhi*

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a pediatric patient on Contact Precautions for suspected or confirmed S. typhi and to wear gowns if contact with the patient or environmental surfaces is likely (1).

AII

Contact Precautions should be considered for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with *S. typhi*

2.2.1 Assessment of HCW Exposure to *S. typhi*

2.2.1.1 Method of Transmission of *S. typhi*

S. typhi is transmitted by ingestion of food or water that has been contaminated with infectious feces or urine; by direct or indirect ingestion of infectious feces or urine.

2.2.1.2 Definition of Occupational Exposure to *S. typhi*

OH should define HCW exposure as a non-immune person having direct or indirect oral contact with infectious feces; exposure may also occur with ingestion of contaminated food or water.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 3-60 days (1). The period of communicability continues as long as the bacilli appear in excreta, usually from the first week throughout convalescence; variable thereafter. About 10 percent of untreated typhoid fever patients will discharge bacilli for about 3 months after onset of symptoms, and 2-5 percent become permanent carriers (22).

2.2.3 Criteria to Confirm the Diagnosis of *S. typhi*

Clinical illness – gradual onset of fever, headache, malaise, anorexia, lethargy, abdominal pain, tenderness, hepatomegaly, splenomegaly, rose spots and/or changes in mental status. Constipation may occur early with diarrhea developing later or not at all.

Plus laboratory evidence – bacterial culture of appropriate clinical specimen positive for salmonella typhi.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with *S. typhi*

2.2.4.1 HCW Exposed to *S. typhi*

OH should refer exposed HCWs for clinical management that may include laboratory investigation.

AIII

There are no work restrictions for HCWs exposed to *S. typhi.*

AIII

2.2.4.2 HCW Carrier of /Infected with *S. typhi*

OH should refer HCWs who are carriers of or infected with *S. typhi* for confirmation of diagnosis and for clinical management that **may/should** include laboratory investigation and antibiotic therapy.

AIII

OH should exclude HCWs with acute *S. typhi* infection from contact with patients and their environment and from foodhandling until stools are negative or as specified by Public Health.

AIII

OH should exclude HCWs determined to be carriers of *S. typhi* until assessed for fitness to work.

AIII

OH should inform Infection Control as soon as possible of a suspected or confirmed case.

AIII

2.2.4.3 OH Management of *S. typhi* Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control and Public Health if an outbreak is suspected.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with *S. typhi*

OH should report case and suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection

with *S. typhi*

OH should design education specific to *S. typhi* according to recommendations outlined in Section A - III including:

- *S. typhi* uncommon, i.e. cases found are chronic carriers, became infected from chronic carriers or are cases as a result of travel,
- safe foodhandling practices,
- case/carrier state,
- difference between *S.typhi* and other salmonella strains.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with *S. typhi*

OH should refer to Section A - IV to develop an evaluation program specific to *S. typhi.*

AIII

VANCOMYCIN RESISTANT ENTEROCOCCUS (VRE)

The majority of the following information has been adapted from Health Canada Infection Control Guidelines *Preventing the Spread of Vancomyocin-Resistant Enterococci (VRE) in Canada.* The reader is encouraged to obtain the document for reference (10).

1. Risk Assessment for Transmission of VRE to HCWs

1.1 Clinical Significance of VRE

Enterococci are normal commensal flora of the gastrointestinal tract in 95% of healthy individuals, and as non-pathogenic colonizing flora in the vagina, oral cavity, perineal area, hepatobiliary tract and upper respiratory tract. Enterococcus species are important nosocomial pathogens having emerged as the second or third most common cause of nosocomial infections. Open wounds and decubitus ulcers may be colonized and act as reservoirs. Enterococci are hardy organisms and are able to survive on environmental surfaces for extended periods.

Over the past two decades there have been increasing numbers of reports of Enterococcus species with resistance to multiple antibiotics. Vancomycin resistance, in *E faecium* and *E faecalis* are of concern as the resistance trait is transferable and has the potential for emergence of vancomycin-resistant *Staphylococcus aureus* or *Staphylococcus epidermidis,* creating major therapeutic dilemmas.

1.2 Evidence of Exposure/Transmission of VRE

Certain patient populations are at increased risk of VRE infection and colonization. Patients (adult and pediatric) from critical care units, hematology/oncology wards, dialysis units, or transplantation units or patients who had major abdominal or thoracic procedures appear to be at higher risk than other populations.

One study demonstrated a significant association between increasing nursing workload and an outbreak of nosocomial *Clostridium difficile* and VRE. The authors concluded overworked nursing staff are less likely to practice good infection control techniques which may facilitate the transmission of both VRE and *Clostridium difficile* between patients (279).

Between 1989 and 1993 in the United States, there was a 23-fold rise in VRE infection, from 0.3% to 7.9% of nosocomial enterococcal infections reported to the National Nosocomial Infections Surveillance system at the Centers for Disease Control and Prevention (280).

The first isolates of VRE in Canada were identified from two patients in 1993 (281). The first outbreak involved 41 patients in the fall of 1995. The outbreak primarily affected patients receiving dialysis (282).

A 1998 survey by the Canadian Hospital Epidemiology Committee (CHEC) representing 21 health care facilities across Canada found that most of the sites had appropriate laboratory procedures for the detection and confirmation of VRE (283). In addition, information from the Canadian Nosocomial Infection Surveillance Program (CNISP) sites demonstrated that

increasing numbers of Canadian acute care facilities were identifying VRE patients (284).

1.3 Evidence of Occupational Transmission of VRE

HCWs colonized with VRE have rarely been implicated in transmission (285).

One study suggested that HCWs and their household contacts are at some risk of acquiring vancomycin resistant *E. faecium*. VRE stool colonization was identified in 3/52 (6%) households with patient-contact employees (286).

No transmission to HCWs in Canada has been reported (284).

Recommendations

Compliance with recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for VRE.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with VRE

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with VRE

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to VRE

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with VRE

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with VRE

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a patient on Contact Precautions for suspected or confirmed VRE and to wear a gown if contact with the patient or environmental surfaces is likely (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with VRE

2.2.1 Assessment of HCW Exposure to VRE

2.2.1.1 Method of Transmission of VRE

VRE is transmitted by direct or indirect contact of hands or skin with infectious feces/urine/wound drainage or with areas of colonized skin.

2.2.1.2 Definition of Occupational Exposure to VRE

OH should define HCW exposure as direct or indirect contact of hands or skin with feces, urine, wound drainage or areas of colonized skin of an infected or colonized patient.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW of exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period varies widely according to clinical presentation, host immune defenses and use of effective antibiotic treatment. Communicability is as long as the carrier state persists.

AIII

2.2.3 Criteria to Confirm the Diagnosis of VRE

Clinical illness – multiple presentations including bacteremia or diarrhea.
OR colonization

Plus laboratory evidence – bacterial culture of appropriate clinical specimen positive for a vancomycin resistant enterococcus; mainly seen in *E. faecalis, E. faecium.*

OR Clinical illness or colonization in a HCW who is epidemiologically linked to a case

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with VRE

2.2.4.1 HCW Exposed to VRE

OH should not routinely culture exposed HCWs (287).

AIII

There are no modifications to work practices or work restrictions for HCWs exposed to VRE.

AIII

2.2.4.2 HCW Colonized/Symptomatic/Infected with VRE

OH should refer HCWs who are colonized/symptomatic/infected with VRE for confirmation of diagnosis and for clinical management that should include laboratory investigation with molecular typing and therapy (287).

AIII

OH should exclude HCWs who are colonized/symptomatic/infected with VRE with diarrhea/wound drainage until symptoms resolve, medical assessment is complete and appropriate control measures and/or work restrictions are determined.

AII

OH should assess the HCW colonized/symptomatic /infected with VRE for fitness for work; assess type of patient/work/ physical setting, hygiene practices, what risk control measures can be utilized and follow-up procedures.

AIII

2.2.4.3 OH Management of VRE Outbreak

OH should investigate the possibility of an outbreak if more than 1 HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control and Public Health if an outbreak is suspected.

AIII

OH should refer HCWs colonized with VRE and epidemiologically linked to patient transmission for medical assessment that may include laboratory investigation with molecular typing.

AIII

OH should exclude HCWs colonized with VRE if proven to be epidemiologically linked to patient transmission until medical assessment is complete and appropriate control measures and/or work restrictions are determined (287).

AIII

OH should assess HCW colonized with VRE and epidemiologically linked to patient transmission for fitness to work; assess type of patient/physical setting/work, hygiene practices, what risk control measures can be utilized and follow up procedures.

AIII

OH should inform Infection Control as soon as possible of a HCW who is colonized or infected with VRE.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with VRE

OH should report case or suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management Exposure to or Infection with VRE

OH should design education specific to VRE according to recommendations outlined in Section A - III and about:

- difference between sensitive and resistant enterococcus,
- difference between infection and colonization,
- why risk is primarily to patients not HCWs,
- intermittent/prolonged fecal shedding,
- what increases transmission, i.e. diarrhea,
- what prevents transmission, i.e. Routine Practices /Additional Precautions
- role of contaminated hands of HCWs in transmission.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with VRE

OH should refer to Section A – IV to develop an evaluation program specific to VRE.

AIII

VARICELLA - ZOSTER VIRUS (VZV)

A. Varicella (Chicken pox)

1. Risk Assessment for Transmission of Varicella to HCWs

1.1 Clinical Significance of Varicella

Varicella-zoster virus (VZV) is the causative agent of both varicella (chicken pox), and herpes zoster (shingles), a reactivation of latent VZV.

Varicella is one of the most communicable of diseases, especially in the early stages of the eruption (22).

Placing patients who are in the infectious stages of varicella (and disseminated herpes zoster) on airborne precautions is recommended to reduce the risk of nosocomial transmission (288).

Varicella is generally a mild disease in healthy children. Serious morbidity and mortality may occur if infection occurs in neonates, adults, or immuno-suppressed patients (22,289,290) **(5010)**.

In Canada, seventy percent (37 of 53) of reported deaths due to varicella from 1987- 1996 were in adolescents and adults greater than 15 years of age (Health Statistics Division, Statistics Canada – Ottawa, unpublished data).

There is insufficient evidence to support the notion that varicella causes more severe illness in pregnant women than in other adults (291).

Maternal infection during the first or early second trimester of pregnancy may result in transmission of VZV to the fetus and cause congenital varicella syndrome. Maternal infection 5 days before through 2 days after delivery can result in severe varicella of the newborn infant. Prior to the availability of effective viral therapies, fatality rates as high as 30 percent were reported but are likely now decreased (22).

A small Canadian multi-centre study funded by a vaccine-manufacturer to estimate the financial burden of varicella from a medical and societal prospective reported a total yearly cost of $122.4 million or $353.00 per individual case (292,293).

1.2 Evidence of Exposure/Transmission of Varicella

A history of varicella is highly reliable, and is valid to determine immunity to varicella (294). Serologic tests are required for those who have an uncertain or negative history (4,295).

Adults who have immigrated from subtropical areas have lower rates of seropositivity and increased VZV susceptibility (296,297).

Rates of HCWs susceptibility to VZV virus are reported to be between1.9 percent to 10 percent (298,299).

In a study to determine the VZV risks for pediatric health care providers, twenty-eight percent of those with uncertain or no known history of varicella were found to be susceptible (300). Persons less than 35 years of age and without previous history of VZV infection are more likely to be susceptible (298).

Varicella is a vaccine-preventable disease. A vaccine was licensed for use in Canada in December 1998 (4,295).

Sixty percent of 170 Canadian health care facilities responding to a survey were found to have well-established pre-employment varicella-zoster screening programs for HCWs, thirty percent imposed work restrictions for susceptible HCWs, and 49 percent used negative pressure rooms for infectious patients (301).

When developing a varicella-vaccine program, the cost of identifying and vaccinating susceptible HCWs, the risks of administering a live vaccine and the possibility of spread of vaccine-induced disease must be considered (294,302,303).

Vaccine has shown to be effective in post exposure prophylaxis use (304,305) but should not be a substitute for an immunization program (4,295). In a population of shelter residents, varicella vaccine given 36 hours post exposure was found to be highly effective in preventing disease. No cases of moderate or severe disease and only two cases of mild disease occurred in children vaccinated following exposure (305).

1.3 Evidence of Occupational Transmission of Varicella

Transmission of varicella-zoster to HCWs has been reported (306-314); index cases (HCWs or patients) of outbreaks in some instances were found to be in the pre-rash phase of varicella (289,306,308).

Transmission occurred among patients and or HCWs who had no direct contact with the index case, providing evidence for airborne spread (288,313).

A report of a 1992 nosocomial varicella epidemic in a large Australian hospital described 20 documented cases in staff; nine of the cases resulted from direct exposure to an index patient. A total of 1655.6 person-days of work were lost with an estimated cost of $18,000 (Australian) (310).

In a review of five unrelated HCW cases of varicella, each case had from zero to sixty HCW and patient contacts. Thirty-nine percent (50) of exposed persons had negative or uncertain histories and were serologically tested. Ten percent were found to be negative. Screening HCWs with a negative history of chicken pox is an acceptable method of determining exclusion requirements amongst contacts(314).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in

Section A, I-IV is required in addition to the following specific recommendations for varicella.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Varicella

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Varicella

OH should liaise with Infection Control and Facility Management to ensure that negative pressure rooms are appropriately maintained and are available for patients suspected or known to have varicella (1,288,315).

AII

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Varicella

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Varicella

OH should document the HCW immune status at preplacement exam (4,290).

AII

OH should consider HCWs to be immune with evidence of a self reported history of varicella or zoster, physician-diagnosed varicella or zoster, documentation of VZV IgG or 2 doses of live varicella vaccine given at least one month apart (for adults) (4,290,295).

AII

OH should screen HCWs without a definite history of VZV for antibody for varicella- zoster (4,295).

AII

OH should ensure immunity to VZV for newly hired staff within 2 months of hiring and for current employees commencing with those who work in high-risk settings (4).

AIII

OH should ensure that by the year 2003, all HCWs have immunity to varicella or an acceptable medical contraindication to vaccination (4).

AIII

OH should immunize all susceptible HCWs with 2 doses of live varicella vaccine given at least 1 month apart (for adults) unless there are contraindications (4,295).

AII

OH should not vaccinate susceptible female HCWs during pregnancy (4,295).

AIII

OH should advise female HCWs of child-bearing age to avoid pregnancy for one month after immunization (295).

AIII

OH should refer non-immune immunocompromised HCWs to their physicians for consideration of immunization (4,295).

AIII

OH should not perform post-vaccine serology on immunized HCWs (4,295).

AI

There is no recommendation for booster doses of vaccination (4,295).

C

OH should inform the non-immune HCW and his/her manager that the HCW should not care for patients suspected or confirmed to have VZV (1).

AIII

OH should exclude non-immune HCWs from working with patients suspected or confirmed to have VZV (1).

AIII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Varicella

OH should ensure that non-immune HCWs who absolutely must enter the room of a patient on Airborne Precautions for suspected or confirmed varicella are provided with an appropriate mask for respiratory protection against varicella.
The mask should meet or exceed the following recommendations:

- filters particles one micron in size
- has a 95% filter efficiency tested in the unloaded state; and
- provides a tight seal (less than 10% facial seal leak) (1).

AII

OH should advise non-immune HCWs who absolutely must enter the room to wear gloves to enter the room of a patient on Contact Precautions for suspected or confirmed varicella and to wear a gown if contact with the patient or environmental surfaces is likely (1).

AII

OH should advise immune HCWs that masks, gloves or gowns are not required(1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Varicella

2.2.1 Assessment of HCW Exposure to Varicella

2.2.1.1 Method of Varicella Transmission

Varicella is transmitted to a non-immune individual by inhalation of airborne virus; or by direct or indirect contact of oral, nasal, or conjunctival mucous membranes with vesicle fluid or respiratory secretions from an infected individual.

Transmission of vaccine virus is rare (295).

2.2.1.2 Definition of Occupational Exposure of Varicella

OH should define exposure as a non-immune HCW inhaling airborne virus from an infectious patient, having face to face contact with an infectious patient, spending one hour in the room with an infectious patient or by direct or indirect contact of oral, nasal or conjunctival mucous membranes with vesicle fluid or respiratory secretions from an infectious patient 2 days before onset of symptoms and until all lesions have crusted over.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of source and assess the potential for communicability at the time of the HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period is 10-21 days, however, this may be extended to 28 days if varicella-zoster immune globulin is given. Individuals are potentially communicable in the 2 days before symptoms appear (1). The period of communicability continues until all lesions are dry and crusted. (1) Contagiousness may be prolonged in those with altered immunity (22).

2.2.3 Criteria to Confirm the Diagnosis of Varicella

Clinical illness – generalized pruritic vesicular rash with mild fever and systemic symptoms; pneumonia, hepatitis or encephalitis may be complications.

Plus laboratory evidence – IgM antibody positive for varicella-zoster; four-fold rise in varicella-zoster IgG antibody; viral culture of an appropriate clinical specimen positive for varicella-zoster.

Or clinical illness in a HCW who is epidemiologically linked to a case in the previous 21 days.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Varicella

2.2.4.1 HCW Exposed to Varicella

OH should determine the immune status of the exposed HCW. If unknown, or only one dose of vaccine, test for IgG antibody.

AII

OH should consider HCW to be immune with evidence of a self reported history of varicella or zoster, physician-diagnosed varicella or zoster, documentation of VZV IgG, or 2 doses of live varicella vaccine given at least one month apart (for adults) (4,290,295).

AII

OH should consider immunizing non-immune exposed HCWs within 3 to 5 days of exposure (4).

AIII

OH should refer exposed non-immune HCWs for clinical management that may include prophylaxis with an antiviral.

AIII

OH should refer immunocompromised or pregnant exposed HCWs for clinical management which should include Varicella - Zoster Immune Globulin within 96 hours of exposure (5,21,115,294).

AIII

OH should exclude non-immune exposed HCWs from work from day 8 following the first exposure, until day 21 after the last exposure (extend the exclusion until day 28, if Varicella – Zoster Immune Globulin is given)(1,5).

AII

2.2.4.2 HCW Symptomatic/Infected with Varicella

OH should refer HCWs who are symptomatic or infected with varicella for confirmation of diagnosis and for clinical management that should include early therapy with an antiviral(5,316).

AI

OH should inform Infection Control as soon as possible of a suspected or confirmed case.

AIII

OH should exclude HCWs with varicella until all lesions are dry and crusted(1)and no new lesions are forming.

AIII

OH should not exclude HCWs with a localized post-immunization varicella-like rash that can be covered with an occlusive dressing (295).

BIII

OH should exclude HCWs with a post-immunization varicella-like rash if the rash cannot be covered and if the HCWs are involved in the care of high risk patients, e.g. immunocompromised and newborn for the duration of the rash (4,295).

BIII

2.2.4.3 OH Management of Varicella Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control and Public Health if an outbreak is suspected.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Varicella

OH should report case or suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Varicella

OH should design education specific to varicella according to recommendations outlined in Section A - III including:

- immunization and prophylaxis recommendations,
- need to inform OH promptly if varicella occurs,
- avoiding exposure to high-risk individuals, (e.g. immunocompromised, pregnant individuals) in the community while infectious because of the serious consequences of disease,
- informing OH of post-immunization varicella-like rash or adverse reactions.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Varicella

OH should refer to Section A - IV to develop an evaluation program specific to varicella including:

a) preplacement immunity seroprevalence
b) rates of single versus outbreak cases
c) rates/number of cases requiring post-exposure intervention (vaccine or Varicella Zoster Immune Globulin)
d) number requiring antiviral treatment
e) number of employees who received pre-exposure vaccine and did not develop varicella post-exposure
f) number of adverse reactions to vaccine (describe symptoms)
g) number requiring work restrictions
h) number of secondary cases
i) number of days of lost work related to varicella exposures and infections
j) surveillance as outlined in Proceedings of the 1999 National Varicella Consensus Conference (4).

AIII

B. Herpes Zoster (Shingles)

1. Risk Assessment for Transmission of Zoster to HCWs

1.1 Clinical Significance of Zoster

Herpes zoster results from dermatomal reactivation of VZV that has been dormant in the dorsal root ganglion of the spinal cord following primary infection with chicken pox. Approximately 15 percent of the population will experience herpes zoster during their lifetime (22,290). Herpes zoster may disseminate in immunocompromised patients with lesions appearing outside the primary dermatome, or with visceral complications (21).

1.2 Evidence of Exposure/Transmission of Zoster

Varicella can be transmitted from the herpetic lesions of individuals who have herpes zoster to varicella - susceptible contacts. This VZV transmission will result in chicken-pox (varicella) infection, not shingles (herpes zoster) in non-immune individuals.

The likelihood of transmission from herpes zoster is much less than that from primary varicella (317). The disseminated form of herpes zoster is presumed to be more communicable due to the larger number of lesions and, thus, infectious virus particles (318).

A report investigating VZV aerosols from localized zoster determined that viral shedding resulted from skin lesions of immunocompromised patients, not a respiratory source (315).

HCWs with herpes zoster in small non-exposed areas that are covered do not pose a substantial risk to patients or HCWs (319).

1.3 Evidence of Occupational Transmission of Zoster

Inappropriate infection control practice for a patient known to have localized herpes zoster resulted in varicella infection in two nurses. As a result, 25 susceptible HCWs were excluded from work and 90 patients were exposed. Although no secondary cases occurred in exposed patients or HCWs the cost to the hospital for paid leave of HCWs was $10, 941.00 (1981 United States dollars) (320).

Three of six susceptible HCWs developed chicken-pox following exposure to localized zoster. Two HCWs had no contact with the source case. The authors reported that air tracer studies indicated the infections probably occurred by "airborne spread"(318).

Recommendations

Compliance with recommendation for the components of an OH program outlined in section A, I-IV is required in addition to the following recommendations specific to herpes zoster.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Zoster

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Zoster

OH should liaise with Infection Control and Facility Management to ensure that negative pressure rooms are appropriately maintained and are available for suspected or confirmed disseminated herpes zoster (1,288,315).

AII

Please refer to pages ___ for 2.1.2 Administrative Controls for Varicella, 2.1.3 OH Work Practices to Prevent HCW Exposure to Varicella, and 2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Varicella that are also indicated for herpes zoster.

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Zoster

2.2.1 Assessment of HCW Exposure to Zoster

2.2.1.1 Method of Transmission of Zoster

The method of transmission of localized herpes zoster is by direct or indirect contact of oral, nasal or conjunctival mucous membrane with infectious vesicle fluid; or rarely by inhalation of aerosolized virus from shedding lesions. Transmission causes varicella in a non-immune person.

In addition, the method of transmission of disseminated herpes zoster is airborne because the virus is in respiratory lesions.

2.2.1.2 Definition of Occupational Exposure to Zoster

OH should define exposure as direct or indirect contact of oral, nasal or conjunctival mucous membranes of a non-immune HCW with vesicle fluid of an infectious patient; additionally define HCW exposure to disseminated herpes zoster as a non-immune HCW being in an enclosed airspace with an infectious patient, e.g. same room, or having face-to-face contact with an infectious patient.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of the HCW exposure.

2.2.2.1 Communicability of the Source

The incubation period is the same as varicella; 10-21 days. The period of communicability continues through to the time the lesions crust over.

2.2.3 Criteria to Confirm the Diagnosis of Zoster

Clinical illness – vesicular skin lesion(s) either localized to a sensory dermatome or disseminated and sometimes accompanied by pain in the area of eruption.

Plus laboratory evidence – viral culture of vesicle fluid positive for varicella – zoster.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Zoster

2.2.4.1 HCW Exposed to Zoster

OH should determine the immunity of the exposed HCW. If uncertain, test for varicella -zoster antibody (4,295).

AII

OH should consider HCW to be immune with evidence of a self-reported history of varicella or zoster, physician-diagnosed varicella or zoster, documentation of VZV IgG or 2 doses of vaccine given at least one month apart (4,295).

AII

OH should refer immunocompromised or pregnant non-immune exposed HCWs for clinical management that should include Varicella - Zoster Immune Globulin within 96 hours of exposure (5).

AIII

OH should exclude non-immune exposed HCWs from work from day 8 following the first exposure until day 21 after the last exposure (extend the exclusion until day 28, if Varicella - Zoster Immune Globulin is given (1,5).

AII

2.2.4.2 HCW Symptomatic/Infected with Zoster

OH should advise HCWs with localized lesions to cover lesions with an occlusive dressing and where possible, cover with clothing when at work.(115,319).

AIII

OH should, within 48 hours, refer HCWs with localized or disseminated herpes zoster for confirmation of diagnosis for clinical management that should include early therapy with an antiviral (5,316).

AI

OH should exclude HCWs with disseminated zoster from work until all lesions have dried and crusted (1).

AIII

OH should exclude HCWs with localized lesions from work only when lesions cannot be covered with an occlusive dressing /clothing and or when handwashing is compromised, until all lesions have dried and crusted (115).

AIII

OH should exclude immunocompromised HCW with localized herpes zoster from direct patient care until lesions are crusted (115).

AIII

OH should inform Infection Control of a suspected or confirmed case of disseminated or uncovered localized zoster as soon as possible.

2.2.4.3 OH Management of Varicella Zoster Outbreak

OH should evaluate the possibility of an outbreak of varicella if more than one HCW or patient on the same unit meets the criteria for diagnosis for either varicella or zoster.

AIII

OH should liaise with Infection Control and Public Health if an outbreak of varicella is suspected related to zoster case(s).

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Zoster

There is no reporting requirement for herpes zoster.

AIII

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Zoster

OH should design education specific to herpes zoster according to recommendations outlined in Section A – III and about:

- advantages of vaccine,
- need to inform OH promptly if zoster occurs,
- herpes zoster not as infectious as varicella,
- covering lesions with an occlusive dressing and clothing while working,
- referral for clinical management if disseminated or localized lesions,
- zoster being a reactivation of latent varicella virus(321),
- risk of serious consequences if transmitted to high-risk individuals, e.g. immunocompromised or pregnant individuals and need to avoid exposure of them.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Zoster

OH should include zoster in the varicella evaluation program.

AIII

VIRAL HEMORRHAGIC FEVER (VHF)

Includes Crimean-Congo hemorrhagic fever, Dengue Fever, Ebola, Lassa Fever, Marburg Virus.

Administration should ensure OH has developed policies and procedures for the prevention and management of HCW exposure to and or infection with VHF, according to the *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases,1997* (11) and related provincial recommendations.

Part II Grouped Diseases/Infections

HEPATITIS A VIRUS (HAV) and HEPATITIS E VIRUS (HEV)

1. Risk Assessment for Transmission of HAV to HCWs

1.1 Clinical Significance of HAV and HEV to HCWs

Hepatitis A is an acute self-limited illness characterized by fever, malaise, jaundice, anorexia and nausea. Usually, the duration of illness is several weeks, but prolonged or relapsing disease lasting as long as 6 months can occur. Chronic infection does not occur and fulminanting hepatitis is rare (21) but when it occurs appears more frequently in adults.

Hepatitis E is an acute illness with a clinical course similar to that of hepatitis A virus (22) including jaundice, malaise, anorexia, fever, abdominal pain and arthralgia (21).

The case fatality rate of hepatitis E virus is less than that of hepatitis A virus except when hepatitis E virus infection occurs in pregnant women. The case fatality rate may reach 20 percent among those infected during the third trimester of pregnancy. Hepatitis E cases occurs only in travelers returning from hepatitis E virus endemic countries, e.g India, Mexico (22).

1.3 Evidence of Exposure/Transmission of HAV and HEV

In Canada, between 1000 and 3000 cases of HAV are reported annually. As of 1994, the reported incidence rates per 100,000 population have varied from 4.4 to 11.2 (322).

Contaminated hands and environmental surfaces are important in the spread of HAV (323).

Although the source of infection was unknown in 44% of the clinical cases of HAV reported to the Centers for Disease and Control and Prevention (CDC) during 1990-92, the most commonly reported risk factor for HAV infection was personal contact with a case (21).

HAV has not been reported to be transmitted by needlestick injury (Boyard, Tablan).

In a study to investigate the cost-effectiveness of HAV vaccination in medical students, the authors stated that routine vaccination would not result in a net cost savings if the risk of HAV to HCWs is the same as that of the general population. They noted the incidence of HCW HAV infection is not known and may be higher than the general population because of HCWs contact with ill and contagious persons. Also, that the rates of the general population are determined by passive reporting and many cases are unreported.

Because the incidence of hepatitis A in the past two decades has decreased, there is an increase in susceptibility in adults and future HCWs will be more susceptible. The authors concluded that routine vaccination may not be warranted at this time but more studies are needed (324).

In the United States and most industrialized countries, HEV cases have been documented only among travelers returning from HEV-endemic countries (21,22).

1.3 Evidence of Occupational Transmission of HAV and HEV

Serological surveys have not found an increased prevalence of HAV infection in HCWs compared with control populations. However, occupational transmission of HAV has been reported (70,71,325-330).

Transmission of HAV to HCWs occurred on two occasions when HCWs cared for infants not known to have acquired HAV from blood transfusions (70,326). One outbreak affected 15 nurses; and risk factors for infection were not documented(70). In the second outbreak, 22 (24%) nurses and 8 other HCWs were infected. Breaks in infection control procedures and, possibly, prolonged HAV excretion in infected infants propagated the epidemic (326).

A case-control study of a burn unit HAV outbreak affecting 11 HCWs implicated eating on the unit as the single most important risk factor for infection. Inadequate handwashing and subsequent oral contamination were identified as the cause of the outbreak that originated with burn patients (a father and son) who were not known to be incubating HAV on admission (71).

A recent outbreak of HAV infection in an adult facility occurred following the admission of a homeless alcoholic patient who was not known to be incubating HAV. The outbreak continued for 11 months affecting 8 nurses, 4 patients and two household contacts. Factors contributing to transmission included; few patient toilets, over crowding in an old facility, poor personal hygiene, behavior of the index patient, nursing inattention to enteric precautions and, nurses eating meals on the ward. The outbreak appeared to stop coincident with mass vaccination (325).

There is no evidence that HCWs are at increased risk of HAV infection (5,322) where standard infection control techniques can be exercised (331).

It has not been determined if vaccination of foodhandlers would be effective in reducing foodborne outbreaks (322,331).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for HAV and HEV.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with HAV or HEV

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with HAV or HEV

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with HAV or

HEV

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with HAV or HEV

Routine HAV immunization for HCWs, including foodhandlers is not currently recommended (5,322).

AII

OH should consider immunization of HCWs who work in institutions for the developmentally challenged where there is an ongoing problem with HAV transmission (5).

AII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with HAV or HEV

OH should advise HCWs to wear gloves to enter the room of a pediatric patient on Contact Precautions for suspected or confirmed HAV or HEV and to wear a gown if contact with patient or environmental surfaces is likely. Contact Precautions should be considered for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with HAV or HEV

2.2.1.1 Transmission of HAV or HEV

HAV or HEV is transmitted by direct or indirect ingestion of infectious feces or by ingestion of contaminated food/water.

2.2.1.2 Definition of Occupational Exposure to HAV or HEV

OH should define HCW exposure as a non-immune person having direct or indirect oral contact with infectious feces; exposure many also occur with ingestion of contaminated food or water.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period for HAV is 15-50 days. The period of communicability is 2 weeks before, to one week after the onset of symptoms except in the newborn where shedding is prolonged (1).

The incubation period for HEV is 15-60 days. The period of communicability is unknown but fecal shedding occurs for at least 2 weeks (21).

2.2.3 Criteria to Confirm the Diagnosis of HAV or HEV

2.2.3.1 HAV Clinical illness – fever, malaise, jaundice, anorexia, nausea.

Plus laboratory evidence – IgM antibody positive for HAV.

Or clinical illness in a HCW who is epidemiologically linked to a case in the previous 6 weeks.

2.2.3.2 HEV Clinical illness – jaundice, malaise, anorexia, fever, abdominal pain, arthralgia.

Plus laboratory evidence – IgG antibody positive for HEV (available in some reference laboratories).

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with HAV or HEV

2.2.4.1 HCW Exposed to HAV or HEV

OH should consider HCWs to be immune to HAV with evidence of hepatitis A immunization or documentation of HAV IgG antibody (5).

AII

OH should refer non-immune HCWs exposed to HAV for clinical management that may include administering Immune Globulin (IG) within 2 weeks of exposure (5).

AII

No recommendation for post-exposure HAV immunization.(5,322).

OH should refer pregnant HCWs exposed to HEV to their physicians for clinical management.

BIII

There are no modifications of work practices or work restrictions for HCWs exposed to HAV or HEV (1).

AIII

2.2.4.2 HCW Symptomatic/Infected with HAV or HEV

OH should refer HCWs who are symptomatic or infected with HAV or HEV for confirmation of diagnosis and for clinical management that should include laboratory investigation.

AIII

OH should exclude HCWs infected with HAV or HEV from foodhandling and from contact with patients and their environment until 7 days after onset of jaundice or other clinical symptoms

(115) or as required by Public Health.

AIII

OH should inform Infection Control as soon as possible of a suspected/confirmed case.

AIII

2.2.4.3 OH Management of HAV or HEV Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with HAV or HEV

OH should report case and suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with HAV or HEV

OH should design education specific to HAV and HEV according to recommendations outlined in Section A - III page and including information on safe foodhandling practices including not to share patient food/chocolates/beverages.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with HAV and HEV

OH should refer to Section A - IV to develop an evaluation program specific to HAV and HEV.

AIII

GASTROENTERIC INFECTIONS

The following information pertains to Adenoviruses, Caliciviruses, Campylobacter, *Clostridium difficile,* Cryptosporidium, Entamoeba histolitica, Escherichia coli-verotoxigenic, Giardiasis, Norwalk, Rotavirus, Salmonella(non-typhi), Shigella, Small Round Enteric Viruses, and undiagnosed diarrheal illnesses.

Please refer to page __ for Hepatitis A and Hepatitis E, and page__ for Typhoid fever.

1. Risk Assessment for Transmission of Gastroenteric Infections to HCWs

1.1 Clinical Significance of Gastroenteric Infections

Bacteria, viruses, protozoa and helminths can cause gastroenteric infections in human beings.

Gastroenteric viruses have been recognized as major human pathogens only over the past two decades and include rotaviruses, adenoviruses, Norwalk and Norwalk-like viruses, caliciviruses and viruses having a coronavirus-like morphology.

Gastroenteric infections present with variable severity ranging from asymptomatic to such symptoms as diarrhea, abdominal pain, malaise, fever and nausea and vomiting. Some infections are accompanied by bloody diarrhea, systemic complications or extra-intestinal syndromes such as hemolytic uremic syndrome or pseudomembranous colitis.

Illness may involve simultaneous infection by two or more organisms. These infections are often treated symptomatically; therefore the causative organism may not always be determined.

1.2 Evidence of Exposure/Transmission of Gastroenteric Infections

Infection with vero-toxin producing *E. coli* is a significant cause of morbidity in Canada. Canada has high rates compared to most countries (332). The reported annual incidence reached a peak of 7.0 per 100,000 in 1991. The incidence has declined and remains at approximately four per 100,000 (333).

1.3 Evidence of Occupational Transmission of Gastroenteric Infections

An intern developed acute diarrhea and serologic evidence of cryptosporidiosis after caring for a patient with chronic infection. One week after the onset of her diarrhea the intern's spouse also developed a diarrheal illness with subsequent cryptosporidium antibody titres. Thirty-one percent (8/26) of exposed HCWs were found to have positive antibody titers. HCWs with significant increased exposure to the patient's infectious feces were more likely to have positive titres. The report noted glove, gown, and masks were not routinely used during daily care. (334).

A healthy intensive care unit nurse acquired cryptosporidiosis from a bone-marrow transplant recipient. The nurse recalled one of the fingers of her glove broke while providing care; no other unprotected contact was reported (335).

E. coli O157:H7 affected 18 of 137 HCWs and 55 of 169 residents in a nursing home outbreak. Hemolytic uremic syndrome occurred in 22 percent of affected residents (8 of 9 cases were fatal). There were no complications or deaths among the affected members of the staff. The source of the illness was thought to be food-borne while subsequent cases spread person-to-person (336).

A Norwalk-like agent was responsible for a hospital-wide gastroenteritis outbreak affecting 27 percent (635 of 2,379) of HCWs. The attack rate was greatest for those working in the Emergency Room, at 69%. The authors hypothesized that the infectious agent became airborne as a result of explosive diarrhea or explosive vomiting or by movement of contaminated laundry. Subsequently, the airborne particles may have been inhaled and swallowed (337).

In a nursing home outbreak, salmonella was transmitted to eight HCWs, (3 of 8 were laundry staff). The authors noted risk for transmission included inconsistent glove use by laundry workers handling grossly soiled linen and laundry workers eating in a "dirty room" that was not regularly cleaned by housekeeping staff (338).

Shigella was transmitted to 3 of 32 (10%) HCWs providing care to an infant with undiagnosed shigella. The infant probably acquired the infection from the mother during birth (339).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for gastroenteric infections.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Gastroenteric Infections

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Gastroenteric Infections

See. Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to Gastroenteric Infections

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Gastroenteric Infections

Oh should advise HCWs not to eat or consume beverages in direct patient care areas. **AIII**

OH should provide information to HCWs regarding the possibility that special attention to environmental cleaning may be required during *C. difficile* outbreaks(1).

AIII

2.1.4 Personal Protective Equipment for HCWs to Prevent Exposure to or Infection with Gastroenteric Infections

OH should advise HCWs to wear gloves to enter the single room or designated bedspace in a shared room of a pediatric patient on Contact Precautions for suspected or confirmed gastroenteric infections and to wear a gown if contact with the patient or environmental surfaces is likely. Contact Precautions should be considered for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment (1).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Gastroenteric Infections

2.2.1 Assessment of HCW Exposure to Gastroenteric Infections

2.2.1.1 Method of Transmission of Gastroenteric Infections

Gastroenteric infections are transmitted by direct or indirect ingestion of infectious feces or by ingestion of contaminated food or water. Airborne transmission has been suggested in some Norwalk-like virus outbreaks (337,340).

2.2.1.2 Definition of Occupational Exposure to Gastroenteric Infections

OH should define HCW exposure as having direct or indirect oral contact with infectious feces; exposure may also occur with ingestion of contaminated food or water.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period and period of communicability varies among organisms and can be found in Health Canada *Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care* (1).

2.2.3 Criteria to Confirm the Diagnosis of Gastroenteric Infections

Clinical illness – diarrhea, abdominal pain, malaise, fever, anorexia, nausea and vomiting;

organism specific manifestations e.g. hemolytic uremic syndrome (verotoxigenic *E. coli*), pseudomembranous colitis (*C. difficile*).

Plus laboratory evidence - viral or bacterial culture or examination of parasites of an appropriate clinical specimen positive for a known gastroenteric pathogen; antigen detection assay of an appropriate clinical specimen positive for a known gastroenteric pathogen.

Or clinical illness in a HCW who is epidemiologically linked to a case within the appropriate incubation period.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Gastroenteric Infections

2.2.4.1 HCW Exposed to Gastroenteric Infections

There are no modifications of work practices or work restrictions for HCWs exposed to gastroenteric infections.

2.2.4.2 HCW Symptomatic with Gastroenteric Infection

OH should evaluate HCWs with evidence of infection, eg. diarrhea, vomiting and refer for clinical management as necessary.

AIII

OH should refer HCWs with clinically significant diarrhea and or vomiting for confirmation of diagnosis and for clinical management that may include laboratory investigation and supportive therapy i.e. maintaining hydration, control of nausea and diarrhea as indicated. Antibiotics are indicated for selected infections, e.g. bacilliary dysentery caused by shigella.

AIII

OH should exclude HCWs with vomiting or diarrhea from contact with patients and their environment and from food handling until stools have formed or as specified by Public Health regulations.

AIII

OH should assess HCWs fitness for work; evaluate for resolution of symptoms; type of patient/work/physical setting, hygiene practices, what risk control measures can be utilized and follow-up procedures.

AIII

2.2.4.3 OH Management of Gastroenteric Outbreaks

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis and appears linked epidemiologically linked to transmission.

AIII

OH should liaise with Infection Control and Public Health if an outbreak is suspected.

AIII

OH may modify work restrictions as necessary in outbreak situations.

OH may consider limiting staff movement among affected and non-affected units/during an outbreak situation.

BIII

2.2.4.4 OH Reporting to Public Health of HCW with Gastroenteric Infection

OH should report laboratory confirmed case or suspected /confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Gastroenteric Infections

OH should design education specific to gastrointestinal infections according to the recommendations outlined in Section A - III and about :

- safe food-handling practices,
- hazards of eating and drinking on patient care units,
- associated risks with some pets.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Gastroenteric Infections

OH should refer to Section A - IV to develop an evaluation program specific to gastroenteric infections.

AIII

RESPIRATORY INFECTIONS

The following information pertains to Adenovirus, Mycoplasma, Parainfluenza virus, Respiratory syncytial virus and Rhinovirus.

Note: for information on Influenza see page__; for Tuberculosis page ___; and for Streptococcus page__.

1. Risk Assessment for Transmission of Respiratory Infections to HCWs

1.1 Clinical Significance of Respiratory Infections

Respiratory infections can present with variable severity ranging from mild upper respiratory illness to pneumonia, and are caused by a variety of organisms. These infections are often treated symptomatically and therefore a causative organism may not be identified.

HCWs are exposed to respiratory pathogens both in the community and in occupational settings; determining if an infection is work related is often difficult and perhaps impossible.

1.2 Evidence of Exposure/Transmission of Respiratory Infections

Respiratory syncytial virus infection has repeatedly been acquired by HCWs, primarily in pediatrics (21). Infection among HCWs can occur by self-inoculation of the eye or mouth with contaminated secretions (21)or, hand contamination from contaminated objects. Transmission of the virus to patients by the hands of HCWs is the principal source of nosocomial infection(341,342).

The use of disposable eye-nose goggles was associated with a significant decrease in patient and staff respiratory syncytial virus infections (343), the use of masks and goggles to enter the room of known respiratory syncytial virus infected patients was associated with a significant reduction of illness in pediatric HCWs (344).

1.3 Evidence of Occupational Transmission of Respiratory Infections

An outbreak of adenovirus infection in 28 of 61 long-term care residents in a pediatric care facility resulted in 11 patient deaths (case fatality rate of 39%) in an eight-week period; 23 HCWs had a similar illness. A higher rate of HCW illness was reported among those providing direct nursing care, especially pulmonary suctioning (345).

Mycoplasma pneumonia was reported to be the cause of an outbreak where 19 of 71 symptomatic HCWs had seroconversions. Twenty-one percent of HCWs developed pneumonia. No patients were infected (346).

Parainfluenza was reported to infect 34 percent (18 of 52) of nurses in a neonatal intensive care unit. The authors reported the reservoir was maintained in HCWs who were then instrumental in the exposure of 24 susceptible children. Of the 17 neonates cultured, six were positive for the virus. Five of six positive neonates were symptomatic and three required ventilatory support

(347).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in section A, I-IV is required in addition to the following specific recommendations for respiratory infections.

2. Risk Control Measures

2.1 Risk Control Measures to Prevent HCW Exposure to or Infection with Respiratory Infections

2.1.1 Engineering Controls to Prevent HCW Exposure to or Infection with Respiratory Infections

See Section A: 2.1.1

2.1.2 Administrative Controls to Prevent HCW Exposure to or Infection with Respiratory Infections

See Section A: 2.1.2.

2.1.3 OH Work Practices to Prevent HCW Exposure to or Infection with Respiratory Infections

See Section A: 2.1.3.

2.1.4 Personal Protective Equipment for HCWs to Prevent HCW Exposure to or Infection with Respiratory Infections

OH should advise HCWs to wear gloves to enter the single room or designated bed space in a shared room of a pediatric patient on Contact Precautions for suspected or confirmed respiratory infection and to wear a gown if contact with the patient or environmental surfaces is likely (1).

AII

OH should advise HCWs to wear a procedure/surgical mask if within one meter of a pediatric patient on Droplet Precautions (1).

AII

Adult patients with respiratory infections are not on Droplet or Contact Precautions (1).

AII

OH should advise HCWs to consider wearing eye protection (face shields or goggles) in addition to masks and gloves when caring for children with respiratory syncytial virus (343).

AII

2.2 Risk Control Measures to Manage HCWs Exposed to or Infected with Respiratory Infections

2.2.1 Assessment of HCW Exposure to Respiratory Infections

2.2.1.1 Method of Transmission of Respiratory Infections

Respiratory infections are transmitted primarily by droplet contact of the oral, nasal or conjunctival mucous membranes with the oropharyngeal secretions of an infected individual and indirectly from hands and articles freshly soiled with discharges of the nose and throat of an acutely ill and coughing individual.

2.2.1.2 Definition of Occupational Exposure to Respiratory Infections

OH should define HCW exposure as droplet or indirect contact of oral, nasal or conjunctival mucous membranes with infectious respiratory secretions.

AIII

2.2.2 Assessment of Source of Health Care Worker Exposure

OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure.

AIII

2.2.2.1 Communicability of Source

The incubation period and period of communicability varies among organisms and can be found in Health Canada Guidelines *Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care* (1).

2.2.3 Criteria to Confirm the Diagnosis of Respiratory Infections

Clinical illness – fever, malaise, conjunctivitis, pharyngitis, headache, cough, bronchiolitis, bronchitis, pneumonia, croup, sinusitis and otitis media.

Plus laboratory evidence – viral or bacterial culture of an appropriate clinical specimen positive for a known respiratory tract pathogen; antigen detection assay on an appropriate clinical specimen positive for a known respiratory pathogen; IgM antibody positive for a known respiratory pathogen; four-fold rise in IgG antibody for a known respiratory pathogen.

Or clinical illness in a HCW who is epidemiologically linked to a case within the appropriate incubation time.

2.2.4 OH Work Practices to Manage HCWs Exposed to or Infected with Respiratory Infections

2.2.4.1 HCW Exposed to Respiratory Infections

There are no modifications of work practices or work restrictions for HCWs exposed to respiratory infections.

2.2.4.2 HCW Symptomatic/Infected with Respiratory Infections

OH should evaluate HCWs with evidence of infection, e.g. sore throat, fever, pneumonia, conjunctivitis and refer for clinical management as necessary.

AIII

OH should assess HCW with evidence of infection for fitness to work; evaluate for resolution of symptoms; type of patient/work/physical setting, hygiene practices, what risk control measures can be utilized and follow-up procedures.

BIII

OH should minimize contact of HCWs with acute respiratory infections with high risk patients, ie. pediatric patients with significant hemolytic congenital heart disease, immunocompromised patients.

BIII

2.2.4.3 OH Management of Respiratory Infection Outbreak

OH should investigate the possibility of an outbreak if there is more than one HCW or patient on the same unit which meet the criteria for diagnosis and appears linked epidemiologically to transmission.

AIII

OH may modify work restrictions as necessary during outbreaks.

AIII

OH should liaise with Infection Control/Public Health if an outbreak is suspected.

AIII

2.2.4.4 OH Reporting to Public Health of HCW with Respiratory Infections

There is no requirement for reporting a single case; report suspected/confirmed outbreak to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Respiratory Infections

OH should design education specific to respiratory infections according to Section A – III.

AIII

4. Evaluation of the OH Program to Prevent and Manage HCW Exposure to or Infection with Respiratory Infections

OH should refer to Section A - IV to develop an evaluation program specific to respiratory infections.

AIII

BLOODBORNE PATHOGENS [General, Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), or Human Immunodeficiency Virus (HIV)]

THIS SECTION WILL ADDRESS OCCUPATIONAL BLOODBORNE PATHOGEN EXPOSURES TO HEALTH CARE WORKERS AS CAUSED BY PERCUTANEOUS INJURIES, CONTACT TO MUCOUS MEMBRANE AND NON-INTACT SKIN, AND BITES. DETAILED INFORMATION ON INJURIES WITH POTENTIAL BLOODBORNE PATHOGEN EXPOSURES IS FOUND IN APPENDIX III. RELATED INFORMATION ABOUT BLOODBORNE PATHOGENS IS COVERED EXTENSIVELY IN OTHER HEALTH CANADA DOCUMENTS LISTED BELOW.

- *Preventing the transmission of bloodborne pathogens in health care and public services settings* (7).
- *An integrated protocol to manage health care workers exposed to bloodborne pathogens* (8).
- *Proceedings of the consensus conference on infected health care workers: risk for transmission of bloodborne pathogens* (6).
- *Guidelines and recommendations on the prevention and control of hepatitis C* (348).
- *Hepatitis C – prevention and control: a public health consensus* (3).
- *A national consensus on guidelines for establishment of a post-exposure notification protocol for emergency responders* (13).
- *Proceedings of a national symposium on risk and prevention of infectious diseases for emergency response personnel* (349).

1. Risk Assessment for Transmission of Bloodborne Pathogens to HCWs

❖ Bloodborne Pathogens - General

1.1. Clinical Significance of Bloodborne Pathogens: Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), or Human Immunodeficiency Virus (HIV)

Bloodborne pathogens are present in the blood and body fluids of some individuals receiving health care and may be transmitted to others with certain types of exposures. Infection with HBV, HCV, or HIV in a patient may be known at the time of care. However, many infected individuals are frequently asymptomatic and the infectious status may be unknown. HBV, HCV, and HIV infections all have the potential for serious adverse outcome, and handling blood and body fluids or sharp equipment contaminated by them is a feature of health care. Therefore, there is a risk of occupational acquisition, and, although seroconversion to a bloodborne pathogen is not thought to happen frequently, the risk is real.

Determinants of occupational transmission of a bloodborne infection include the following:

- the risk of exposure to blood and body fluids,
- the prevalence of infection in the client population,
- the efficiency of transmission following a significant exposure to infected blood/ body fluids (7),(8,13) [1486], and
- the immune status of the exposed person (5)

- the control measures in place to prevent the exposures and transmission of infection to HCWs (7).

These factors are further affected by other variables related to the virus, equipment design and work practices. Risk is not equal for all viruses, for all work practices or for all HCWs.

1.2. Evidence of Exposure/Transmission of Bloodborne Pathogens

The most common cause of blood and body fluid occupational exposures to HCWs is by a percutaneous injury, e.g. needlestick. Studies indicate that of all percutaneous injuries, those by a hollow bore needle are responsible for 59% - 91% of HCW exposures to blood (66,350-353) whereas, other sharp injuries, e.g. a cut with a sharp instrument or suture needle, accounted for only 6 – 10% of exposures due to percutaneous injuries (351,353,354).

HCW exposures of blood and body fluids via mucous membranes account for 10% - 14% of occupational exposures (66,351,354,355).

Thirteen percent of the Canadians who reported to the "National surveillance of occupational exposure to the Human Immunodeficiency Virus (HIV)" had blood or body fluid exposures to non-intact skin (351).

The Occupational Safety and Health Administration of the United States Department of Labor estimates that 600,000 needlesticks occurred to United States HCWs in 1996[3], one for every 10 HCWs[4], 80% of whom were nurses. The calculation of numbers is based on HCW injuries in participating hospitals and includes adjustments for a 39% non-reporting rate and for the 50% of HCWs who work outside the hospital.

1.3. Evidence of Occupational Transmission of Bloodborne Pathogens

In Canada, in 1997 and 1998, 46 and 61 HCWs respectively, received compensation for occupational lost time due to injuries with needles and syringes. The exposure did not result in disease (type not specified) or illness at the time (356) (357).

Fifteen HCWs in Canada in 1997 and 27 in 1998 received compensation for occupational lost time generally where some disease (type not specified) or illness resulted from needlestick injuries (356) (357). In both categories of HCW exposures and injuries registered nurses and nurse supervisors were the groups of employees affected.

The risk of infection following occupational exposure varies with each pathogen. See p _____ for HBV, p _____ for HCV, and p _____ for HIV.

3 http://www.osha-slc.gov/sltc/needlestick/index.html

4 http://www.med.Virginia.EDU/medcntr/centres/epinet/estimates.html

❖ **Risk Assessment of Hepatitis B Virus (HBV)**

1.1 Clinical Significance of HBV

HBV causes a wide spectrum of manifestations, ranging from asymptomatic infection in about 50 – 70 % of adults to subacute illness with nonspecific or extrahepatic symptoms and acute clinical hepatitis with jaundice to fatal fulminating hepatitis (22).

Chronic HBV infection with persistence of hepatitis B surface antigen (HBsAg) occurs in five to 10% of those infected as adults (21). Forty percent of HBV carriers who have severe, hepatic lesions will develop cirrhosis. Cirrhosis is a precursor of hepatocellular carcinoma in later life (358). Fulminating hepatitis is a rare consequence of primary HBV infection and although occurring in fewer than 1% of patients, has an 80-90% mortality rate (55,358,359).

Hepatitis B surface antigen can be found in virtually all body secretions and excretions; however, only blood (and serum derived fluids), saliva, semen and vaginal fluids have been shown to be infectious (22).

The presence of hepatitis B "e" antigen (HBeAg) indicates high virus titre and higher infectivity. The risk of transmission of HBV to non-immune health care workers varies from 1-6% when hepatitis B "e" antigen is absent (358,360,361) or 19-30 or 40% when it is present (358,361-363).(363) Combining passive-active post-exposure prophylaxis with hepatitis B immune globulin (HBIG) and three doses of hepatitis B provides better protection than HBIG or vaccine alone (358,364).

Because HBV may survive on environmental surfaces for more than a week, indirect exposure to HBV can occur via contaminated inanimate objects and appears to have been a factor in HBV outbreaks among patients and staff of hemodialysis units (22,361,361).

The risk of transmission of hepatitis B virus is reduced by immunization against hepatitis B, which is 90-95% effective in immunocompetent working-age adults (5). Immunization for HCWs in higher risk areas, e.g. operating room staff; emergency room and ambulance staff; intravenous teams; blood bank staff; staff on oncology, nephrology, and hepatology units; pathologists and morgue attendants; surgeons; dentists, dental assistants, and hygienists; residents for the mentally retarded; homosexuals; injection drug users; sexual and household contacts of carriers; and embalmers began in Canada in 1982 (365,366). Although the initial vaccine against hepatitis B was not responsible for AIDS transmission (367), the use of plasma-derived hepatitis B vaccine was replaced by recombinant vaccine in Canada in 1987.

Routine booster doses of hepatitis B vaccine for HCWs who have had a documented antibody response of 10 international units per litre to hepatitis B surface antigen are not necessary in an immunocompetent person as the protection persists as a result of an anamnestic response that usually occurs within two weeks of re-exposure to the hepatitis B virus, earlier than the incubation period of 45 days (5,358,368,369).

A Winnipeg study indicated only 55% of high-risk university hospital staff were immunized in 1990 (370).

In a Montreal study of community service centres and home care, 51.5% of health care workers, including nurses, home attendants, dentists, and physicians were immunized against hepatitis B in 1993 (355).

A 1995 Canadian survey to a stratified random sample of over 6,000 dentists indicated 68-100% of dental hygienists had received hepatitis B immunization and 46-100% of all other clinical staff were immunized (371). Ninety-four percent of dentists reported in the same survey that they had received hepatitis B immunization or had acquired immunity (372).

In 1994-5, Centers for Disease Control and Prevention surveyed 200 U.S. hospitals that conducted an employee chart review of 25 randomly selected employees. The study indicated that 72% of nurses, 81% of phlebotomists/technicians, and 71% of physicians had received 3 doses of hepatitis B vaccine (373).

1.2 Evidence of Exposure/Transmission of HBV

The most common means of transmission of HBV are sexual or household contact with an infected person, perinatal transfer from mother to neonate, injection drug use, and nosocomial infection (22). Contaminated transfusions are an infrequent cause of infections now that blood is screened (1: 63,000) (374).

There is evidence of transmission of hepatitis B with minute amounts of contaminated blood. In 1990 in a California diabetic clinic, patients who underwent capillary blood sampling by finger-stick with a spring–loaded lancet device were more likely to contract hepatitis B infection than those who did not. The platform was not changed after each use of the device and hepatitis B was transmitted to 26 patients via sharing of the spring-loaded device between HBV-infected and HBV-susceptible patients (375).

In 1996, nine of 67 patients in an Ohio nursing home and 14 patients in a New York City hospital also contracted hepatitis B probably due to a pen-like device for doing finger-sticks for glucose testing (376).

One person has developed hepatitis B following an endoscopy with a scope used previously on a on a hepatitis B positive patient (377).

HBV has been transmitted in an ocular exposure (364).

Although saliva does not often transmit hepatitis B, it is possible. A teacher at a school for developmentally handicapped children was bitten and became infected when she removed some material from the mouth of a student during a choking episode. The student was in the acute phase of hepatitis B illness and tests done on the saliva indicated it was hepatitis B surface antigen positive and negative for occult blood (378).

1.3. Evidence of Occupational Transmission of HBV

There were three cases of compensated occupational hepatitis cases in HCWs in 1998 to either

nurses or nursing supervisors (357).

Studies also indicate that HCWs are at higher risk of hepatitis B infection compared to non-HCWs and that categories of HCWs having greatest exposure to bloodborne pathogens are at particularly high risk. Early studies compared the increased risk of hepatitis B infection in health care workers and non-health care workers rather than testing workers at the time of exposure and determining the number of occupational seroconversions. The studies indicated that HCWs, e.g. surgeons, pathologists, blood bank staff, and surgical house officers, had three to four times increased risk of infection and that their risk increased with the number of years worked in health care and in hemodialysis, surgery, laboratory work, and emergency care but their risk decreased if they were working in pediatric and rural hospitals (358,364,379,380).

Centers for Disease Control estimated that 5100 HCWs with frequent blood contacts developed hepatitis B due to their work in 1991 (381).

In 1992, the Centers for Disease Control estimated that 6,800 non immunized health care workers who worked in jobs with the potential of exposure to blood would become infected with HBV every year; 250 would be hospitalized as a result of acute complications and approximately 100 would die from cirrhosis, liver cancer, or fulminating hepatitis (382).

As a result of the U.S. Occupational Safety and Health Administration bloodborne pathogen standard that requires employers to provide hepatitis B immunization, the number of health care workers who have been immunized has increased and the number with hepatitis B disease has declined dramatically. Centers for Disease Control and Promotion, in a review of employee records, estimate that 400 new hepatitis B infections occurred in health care workers in 1995. While the hepatitis B infections were not necessarily occupational ones, the incidence of HBV infections changed from three times higher to five times lower than the general population in the period from 1983 – 1995 (373).

A clinical trials nurse died 20 years after developing hepatitis B while learning to draw blood in nursing school (383).

France reported 10 documented cases of occupational HBV infection in 1983 but these were reduced to 1 case by 1993 by achieving a 94% hepatitis B immunization coverage with 92% of health care workers showing an adequate response rate (384).

❖ Risk Assessment of Hepatitis C Virus (HCV)

1.1. Clinical Significance of HCV

HCV is the primary etiologic agent of parenterally transmitted non-A non-B hepatitis. About 90% of initial infections are asymptomatic and 50 – 80% will develop chronic hepatitis C (22). Twenty per cent of those with chronic infection will develop cirrhosis and primary hepatocellular carcinoma is 5-50 times higher in HCV antibody-positive patients than in HCV antibody-negative patients (385).

Population based studies in the U.S. indicate that 40% of chronic liver disease is HCV related, resulting in an estimated 8,000 to 10,000 deaths each year (386).

In Canada, 2/3 of people with hepatitis C infection have genotype 1 (3). Genotyping is an important factor for planning optimal treatment and has prognostic value of response to current hepatitis C treatment regimens.

A 1998 report by Remis estimated the seropositive rate in Canada at 0.8% (3).

Current laboratory technology to diagnose hepatitis C infection has limitations. However, the third generation serological assays in use now are highly sensitive and detect HCV antibody in 90-95% of infected persons (385,387). Antibody testing is unreliable in immunosuppressed patients, e.g. patients with hypogammaglobulinemia on renal dialysis, in organ transplant recipients (388) and in those with severe chronic liver disease. As well, current laboratory technology cannot readily distinguish between acute and chronic infection except by detecting seroconversion with repeated testing over time. There is no sero-marker for resolved infection. There may be a prolonged period between the onset of acute illness and seroconversion causing laboratory results to be subject to the timing of the testing. In populations like the Canadian one with a low prevalence rate of infection, the rate of false positivity of HCV is high (385). All positive results should be confirmed by a supplemental test.

HCV RNA can be detected by the reverse transcriptase/polymerase chain reaction (RT/PCR) method. Positive RNA is indicative of the presence of the virus and infectivity. The RNA titre is used to guide treatment and to verify HCV infection in an immunocompromised patient. It may be used to confirm HCV infection in someone who is HCV antibody negative but infection is suspected. It is also used for research projects (348). The levels of HCV RNA may be intermittent during the course of the disease (385). A negative HCV PCR over time may indicate resolved infection.

The average interval between occupational exposure and seroconversion is 6-10 weeks but may vary from 2-26 weeks (3,385).

In 1998, Alter states that the incidence of seroconversion following accidental sharps exposures was 1.8% (range 0 – 7%). An incidence of 10% was quoted in Japan following HCV RNA by PCR testing (385). In a national database analysis of 62,500 Italian HCWs since 1986, the rate of hepatitis C infection for percutaneous exposures was 0.45% (14/3076) and 0.36% following

mucocutaneous exposures (2/557). There were no transmissions observed in the Italian study following non-intact skin exposure (77).

The HCV genome mutates during viral replication making it difficult to develop a vaccine to a changing viral structure [ ].

1.2 Evidence of Exposure/Transmission of HCV

The major means of transmission of hepatitis C is by injection drug use (60-70%) (3) [6459] and 10-15% (3)of all hepatitis C cases are due to transmission of blood or blood products before 1990 or receipt of blood-derived coagulation products before 1985 (8). The risk of transmission of HCV in blood transfusions is about 1: 103,000 (374). Ten to fifteen per cent of acute hepatitis C cases reported in the US are from community exposures (386). Sexual exposures are the primary risk factor and may account for up to 20% of HCV transmissions (389). Two-thirds of the community exposures have an anti-HCV partner and one-third have had more than two partners in the previous six months (386). The rate of transmission in monogamous relationships is low, about 2.5% in Canada (348).

Other HCV transmission has been reported to occur following a wide range of household and community percutaneous and mucosal contacts (385,388,390-393).

Hepatitis C, but not HIV was transmitted following the sharing of cleaned intravenous drug injecting equipment despite exposure to both viruses (394).

HCV has been transmitted by a lancet injury in a diabetic clinic in France (395).

Hepatitis C was transmitted to two patients following a colonoscopy with biopsy (377).

Hepatitis C has been transmitted via saliva [ ].

1.3. Evidence of Occupational Transmission of HCV

In the United States, 22 hospitals participating in the National Surveillance System for Hospital Health from 1995-1998 documented 5 health care workers who acquired HCV infection; all 5 injuries occurred with visibly bloody devices; 4 involved hollow-bore needles used for venous access; and 4 were exposed to sources co-infected with HIV (396). Statistical significance was not given.

In Italy 10 HCWs of 2440 seroconverted to HCV during the years of 1994-8. These workers were followed as part of the Italian national hospital database study. All ten HCWs had moderate or deep injuries with hollow-bore blood filled needles (397). A total of 14/3076 exposures to hepatitis C resulted in infection since the Italian database started in 1986 (77). The results were not statistically significant.

Two HCWs in Japan were exposed to HCV due to percutaneous injuries. The first was a 44 year old female nurse who was seronegative to HBV, HCV, and HIV at the time of injury. Her

alanine aminotransferase was also normal but at 1.5 months her alanine aminotransferase was elevated. At 1.8 months HCV RNA was detected in her serum and at 2.2 months she was HCV antibody positive (398). The second Japanese case was of a 27 year old male surgeon who was seronegative to HBV, HCV, and HIV at the time of injury. His alanine aminotransferase was also normal at baseline. At 1.5 months he had an elevated alanine aminotransferase; at 1.6 months HCV RNA was detected in his serum and at 3 months, he was HCV antibody positive (398).

One health care worker was infected with both HCV and HIV following a dual injury, i.e. a needlestick injury and a spill of blood from a collection vial into her gloves, on chapped hands (399,400,400). She died 28 months after the exposure from hepatic coma and renal failure.

One case of simultaneous HCV & HIV transmission was reported following a blood splash to the eye (401). HCV has been transmitted by other ocular exposures in the US (402).

❖ Risk Assessment of Human Immunodeficiency Virus (HIV)

1. 1. Clinical Significance of HIV

HIV is a virus that causes a wide spectrum of illness including acquired immune deficiency syndrome (AIDS). AIDS is a severe, life threatening clinical condition. The syndrome represents the late clinical stage of HIV disease that results from progressive damage to the immune and organ systems including the central nervous system (22).

HIV infected people are at greater risk of infection and serious complications from opportunistic pathogens, e.g. tuberculosis and pneumocystosis.

1.2. Evidence of Exposure/Transmission of HIV

HIV is transmitted to others via sexual contact, injection drug use, mother to neonate (22) The estimated risk of transmission of HIV in blood transfusions is 1: 913,000 (374).

HIV has been transmitted by human bite (403).

HIV has been transmitted from an HIV infected child with a zidovuding-resistant mutation to another child in the same home, probably from an unknown blood exposure (404).

1.3. Evidence of Occupational Transmission of HIV

Epidemiological studies have shown that the risk of transmission of HIV to health care workers from HIV infected patients is approximately 0.3% for needlestick exposures (68,358,405-410). (407-409)
(68,406)
Percutaneous exposure is a more effective means of transmission than mucous membrane exposure. Seroconversion following a mucous membrane exposure is 0.09% (358,362,410-413).

The Canadian *National surveillance of occupational exposure to the Human Immunodeficiency Virus* (351) shows that the major cause for potential exposure by health care workers to HIV in Canada is via percutaneous exposures, e.g. from needlestick (62%) and surgical instruments (6%). Eleven per cent of exposures to blood are to mucous membranes and 13% are on non-intact skin (351).

There has been one occupational HIV percutaneous transmission documented in Canada in 1995. The incident occurred to a HCW who sustained a shallow puncture wound from a small gauge needle (21-25). There was a small amount of blood at the wound site. As the incident was trivial the HCW did not seek antiretroviral drugs. Unfortunately the source person was in the late stages of AIDS and the HCW seroconverted to HIV (414).

A possible occupational transmission occurred to a 75 year old Ontario biochemist who had worked in many laboratories with blood and blood products. There were no other risk factors reported (415).

Another reported possible occupational transmission occurred to a Quebec laboratory technician in the early 1990's. This case is still under investigation (416).

In Canada, there has been no reported case of HIV transmission from non-intact skin or mucous membranes exposure in the *National surveillance of occupational exposure to the Human Immunodeficiency Virus* as of 1999 (351).

There were seven cases of compensated occupational HIV in 1998 (357) that were to the HCW occupational group of either nurses or nursing supervisors.

In the United States, 56 health care workers have documented and 136 have possible occupational transmission of HIV as of December 1999 (417). In Europe, the United Kingdom, and the rest of the world, there have been 28, 4, and 11 documented occupational HIV seroconversions and 56, 8, and 13 possible HIV seroconversions respectively (418).

Although mucous membrane exposures have resulted in HIV seroconversion in the U.S. HCWs, in 15 prospective studies in the US with 2,071 mucous membrane exposures, no seroconversions have occurred (353)

In Italy the transmission rate following percutaneous exposures as collected in their national database for bloodborne pathogen exposures was 0.14% (3/2125), and 0.43% (2/468) following mucocutaneous exposures, both rates being higher than previously estimated in both North America and Italy (77). The results were not statistically significant.

Some HIV infections result from very small injuries. In Germany, while a nurse was washing the patella of an AIDS patient, her gloved hand accidentally touched a tip of the internal wire to fix the joint. The wire was exposed due to the wasting condition of the patient. The injury was superficial, of 3 millimeters in length, and hardly bleeding. She had immediate prophylactic zidovudine therapy and she seroconverted months later (419).

Some exposures are more hazardous than others, e.g. following an occupational exposure. HCWs are more at risk if the exposure involves a larger quantity of blood as the following three examples:

- 16.5 times more likely to become infected with HIV from a deep percutaneous injury;
- 5.2 times more likely to become infected with HIV from visible blood on the device causing injury; and
- 5.1 times more likely to become infected with HIV from needle used for vascular access.

The risk increases if the viral titre is higher, i.e. the HCW is 6.4 times more likely to become infected from source patient with high viral load (end stage AIDS or acute retroviral illness) (350).

In a retrospective case-control study carried out from 1988 to 1994 in the U.S., United Kingdom, and France, the risk of occupational transmission of HIV was reduced by 79% when health care

workers were given zidovudine (ZDV) as post-exposure prophylaxis (350).

Health care workers may be exposed and infected by more than one bloodborne pathogen concurrently. One case of a simultaneous infection with HIV and hepatitis C virus following an occupational conjunctival exposure to blood has been reported (401).

When health care workers are exposed to more than one bloodborne pathogen, the seroconversion to HIV may occur later than the usual six months. One of 4 health care workers co-infected with HCV in the National Surveillance System for Hospital Health study was positive for HIV 13 months after exposure but the HIV test was negative at 6 months (396).

Recommendations

Compliance with the recommendations for the components of an OH program outlined in Section A, I-IV is required in addition to the following specific recommendations for bloodborne pathogens:

2. Risk Control Measures

2.1. Risk Control Measures to Prevent HCW Exposure to or Infection with Bloodborne Pathogens

2.1.1. Engineering Controls to Prevent HCW Exposure to or Infection with Bloodborne Pathogens

OH should liaise with Administration and Infection Control to ensure that hazardous devices are replaced with equipment proven by evidence to have a safer design (56,420) that includes consideration of the following:

- automatic retractable needles to reduce injuries at the point of use (421) and to eliminate the need to recap (422)
- needleless intravenous systems to reduce injuries at point of use and eliminate the need to recap (423-429)
- retractable intravenous catheter needles and blunt suture needles to eliminate injuries at point of use (38,430)
- automatic retractable needles (431,432) and site – appropriate sharps disposal equipment to eliminate after-use injures (433)
- alternatives to butterfly needles
- automatic devices in the laboratory

AII

2.1.2. Administrative Controls to Prevent HCW Exposure to or Infection with Bloodborne Pathogens

Administration should ensure OH develops policies and procedures to obtain consent for all testing, including HBV, HCV, and HIV (8,13).

AIII

2.1.3. Occupational Health Work Practices to Prevent HCW Exposure to or Infection with Bloodborne Pathogens

OH should document HCW immune status for hepatitis B on pre-placement exam (5,27,28).

AII

OH should consider HCWs to be immune to hepatitis B with evidence of 3 doses of hepatitis B vaccine given at 0, 1 and 6 months and one documented adequate antibody titre of equal to or greater than 10 international units per liter or documentation of HBV IgG done at least 4-8 weeks post-immunization (5,8).

AII

OH should consider all HCWs to be susceptible to hepatitis C and/or HIV even if laboratory documentation of previous infection since infection with one genotype of either virus is not protective against infection with another genotype of that virus.

AIII

OH should immunize all HBV susceptible HCWs who may be exposed to blood, blood products or body fluids or may be at increased risk of sharps injury, bites or penetrating injuries, e.g. staff of institutions for the developmentally challenged with 3 doses of hepatitis B vaccine, given at 0, 1, and 6 months unless contraindicated (5).

AIII

OH should conduct serologic testing for hepatitis B surface antibody *4-8 weeks* (8) or at least within 6 months following the complete hepatitis B immunization series (5).

BII

OH should immunize HCWs who did not produce hepatitis B surface antibody after an initial 3-dose vaccine series (non-responders) with a second 3-dose series of hepatitis B vaccine and repeat serologic testing (5).

BII

OH should consider HCWs who do not produce hepatitis B surface antibody after 2 complete series of HB vaccine (non-responders) as susceptible to hepatitis B indefinitely (5,8). Further hepatitis B immunization is unlikely to create immunity.

BII

OH should advise HCWs that booster doses are not recommended for hepatitis B (5,358,368,369).

BII

OH should advise HCWs who have been immunized for hepatitis B but who never received post-immunization serologic testing either to seek testing for hepatitis B surface antibody post-

exposure to blood or body fluids (5) or to consider receiving one additional dose of hepatitis B vaccine and have testing done *4-8 weeks* after completion (8) or at least within 6 months (5).

AII

OH should advise HCWs who perform exposure-prone procedures to know their serologic status for HBV, HCV, and HIV and to follow the recommendations in *Proceedings of the Consensus Conference on Infected Health care workers: Risk of Transmission of Bloodborne Pathogens* (6).

AII

OH should develop strategies to achieve hepatitis B immunization of 100% of HCWs who may be exposed to bloodborne pathogens such as:

- Increase compliance of immunization coverage by offering vaccine in unusual work situations, e.g. at the work site (370), at meetings, and on all shifts (65) and sending reminder letters for subsequent doses (370).

AII

- collaborate with associated HCW educational facilities to have hepatitis B vaccine immunization and post-vaccination testing to confirm protection and proof of immunity prior to clinical practice in the educational program.

AIII

OH should analyze data from needlestick injuries to determine surveillance rates that include, but are not limited to (430):

- Type and size of device (36)
- Type of procedure and the degree of risk involved
- Task of health care worker
- Location of the incident
- Circumstances of the incident; equipment problems (36)
- Time of exposure
- Workload
- Change in rates of injuries before and after introduction of a safety device and if the safety feature was activated (32,51).

AII

OH should provide leadership on a multidisciplinary committee for sharps prevention whose role it is to:

- Define the priorities for safety products according to the epidemiological analysis of the institution's injury data (28,36);
- Determine the goal for the decrease in needlestick injuries (32);
- Determine the selection of design (a safety feature that is simple, reliable, and self-evident to operate) and performance criteria (design and performance for patient care and worker safety) for products associated with high risk of injury/exposure e.g. involving large volumes of blood, vein or artery placement,

potential for deep injury (51,429). Cost and any potential increased risk of the patient to infection by use of such products should be considered (36);
- Evaluate clinical studies; review other written resources on safer devices (429);
- Identify, evaluate, and select sharps prevention technology to pilot test in the clinical area by staff (61,72);
- Select and recommend effective equipment chosen from the pilot study (51),
- Arrange for hands-on-training for equipment use (31,51);
- Assess outcomes of equipment and/or procedure changes and identify unanticipated problems as part of the evaluation process (29,36);
- Establish a process for reporting product problems to the manufacturer (32);
- Participate in research initiatives, if possible, to support the need for safer equipment and/or procedures and the ultimate benefit to patient care (429);
- Design interventions, including work practices and modification of procedures, tailored to reduce specific occupational hazards (47) without compromising patient safety.
- Conduct research on staffing patterns and needlestick injury rates (31), if possible;
- Contribute to a list of effective safer devices available (31,62,72) in Canada and maintained by Health Canada for the use of acute-care (large and small), long-term care (LTC), emergency responders, and home care staff; (The Health Canada site needs to be established. U.S. resources are available on the Web at http://www.med.Virginia.EDU/medcntr/centres/epinet.)
- Study cost-effectiveness of safer equipment (51);
- Determine the necessity for extra training to adapt to the new technology once it is chosen, e.g. practices of phlebotomy and insertion of intravenous catheter may require technique changes (34);
- Review target goals for reduction in needlestick injuries and provide remedial action if necessary (32);
- Encourage manufacturers to conduct post-marketing studies (36); and
- OH should consider participation in the Canadian Needle Stick Surveillance Network (CNSSN) to pool data regarding needlestick injuries and seroconversions [see Appendix IV].

AIII

OH should advise HCWs with significant dermatitis regarding increased risks of exposure to blood borne pathogens (434), how to minimize risk, and remove from direct patient care if necessary .

AII

2.1.4. Personal Protective Equipment For HCWs to Prevent Exposure to or Infection with Bloodborne Pathogens

See Section A: 2.1.4.

Additional information is available in *Infection control guidelines for preventing the transmission of bloodborne pathogens in health care and public service settings* (7).

2.2. Risk Control Measures to Manage HCWs Exposed to or Infected with Bloodborne Pathogens

OH should instruct HCWs to allow immediate bleeding of a percutaneous injury and wash the injured area well with soap and water, applying an antiseptic, if available, as a first aid measure (7,8).

AIII

OH should instruct HCWs to flush eyes, nose or mouth with copious amounts of water as a First Aid measure if contamination occurs (7,8).

AIII

OH should instruct HCWs to wash skin with soap and water if contamination by blood occurs (7,8).

AIII

2.2.1. Assessment of HCW Exposure to Bloodborne Pathogens

2.2.1.1. Method of Transmission of Bloodborne Pathogens

Bloodborne pathogens are transmitted primarily by percutaneous injury with equipment contaminated with blood or body fluids but also by mucous membrane or non-intact skin contact with blood or body fluids. See *An integrated protocol to manage health care workers exposed to bloodborne pathogens* (7,8).

The types of body fluids capable of transmitting HBV, HCV, and HIV from an infected individual include (8):

- Blood, serum, plasma and all biologic fluids visibly contaminated with blood;
- Laboratory specimens, samples or cultures that contain concentrated HCV, HBV, HIV;
- Organ and tissue transplants;
- Pleural, amniotic, pericardial, peritoneal, synovial and cerebrospinal fluids;
- Uterine/vaginal secretions or semen (unlikely to be able to transmit HCV); and
- Saliva for HBV only, unless contaminated with blood.

Feces, nasal secretions, sputum, tears, urine and vomitus are not implicated in the transmission of HCV, HBV and HIV unless visibly contaminated with blood. The risk of transmission from screened donated blood and manufactured blood products is negligible in Canada.

2.2.1.2. Definition of Occupational Exposure to Bloodborne Pathogens

OH should define HCW exposure as a percutaneous injury from equipment contaminated with blood or body fluids (see 2.2.1.1); or mucous membrane or non-intact skin contact with blood or body fluids (see 2.2.1.1). Blood on intact skin is not an exposure (13). See *An integrated protocol to manage health care workers exposed to bloodborne pathogens* (8).

AIII

2.2.2. Assessment of Source of Health Care Worker Exposure

The OH should confirm the diagnosis of the source and assess the potential for communicability at the time of HCW exposure (8).

AIII

OH should determine circumstances of the injury which may be associated with a higher risk of disease transmission, e.g. depth of percutaneous injury; type of device, e.g. hollow-bore; visible blood on device; device used for vascular access; source patient with high viral load or terminal phase of illness (350).

AII

2.2.2.1 Communicability of Source

The incubation period for:

- Hepatitis B is 45-180 days and the period of communicability is as long as Hepatitis B surface antigen is present in the blood,
- Hepatitis C is 14-180 days and the period of communicability is from the time HCV is present in the blood and continues throughout life,
- HIV is usually 30-90 days but may be longer. The period of communicability is from the time the virus is present in the blood and persists throughout life. See *Guidelines for preventing the transmission of bloodborne pathogens in health care and public service settings* (7,22).

2.2.3. Criteria to Confirm the Diagnosis of Bloodborne Pathogens

2.2.3.1 Hepatitis B

Clinical illness – acute: fever, pharyngitis, rash, lymphadenopathy
- chronic: anorexia, abdominal discomfort, nausea, vomiting, arthralgias, rash, jaundice or asymptomatic.

Plus laboratory evidence – Hepatitis B surface antigen positive for HBV; HBV-RNA positive (available at some reference laboratories).

2.2.3.2 Hepatitis C

Clinical illness - anorexia, abdominal discomfort, nausea, vomiting, jaundice or asymptomatic.

Plus laboratory evidence - antibody to HCV positive; HCV-RNA positive (available at some reference laboratories).

2.2.3.3 Human Immunodeficiency Virus/AIDS

Clinical illness – generalized lymphadenopathy, hepatomegaly, splenomegaly, oral candidiasis, recurrent diarrhea, wasting syndrome, neuropathy, acquired immunodeficiency syndrome (AIDS) or asymptomatic.

Plus laboratory evidence – antibody to HIV positive; HIV-RNA positive; HIV provirus positive; HIV p24 antigen positive (available at some reference laboratories).

2.2.4. OH Work Practices to Manage HCWs Exposed to or Infected with Bloodborne Pathogens

2.2.4.1. HCW Exposed to Bloodborne Pathogens (HBV, HCV, or HIV)

OH should determine immune status of the exposed HCW. If the HCW immune status for HBV, HCV or HIV is unknown or uncertain, OH should test the HCW for hepatitis B surface antigen (HBsAg), anti-hepatitis B surface antigen (anti-HBs); anti-hepatitis B core antigen (anti-HBc), hepatitis C virus antibody (anti-HCV), serum alanine aminotransferase (ALT) and HIV antibodies. See *An integrated protocol to manage health care workers exposed to bloodborne pathogens* (8).

AII

OH should consider HCWs to be immune to hepatitis B with evidence of 3 doses of hepatitis B vaccine given at 0, 1 and 6 months and one documented adequate antibody titre of equal to or greater than 10 international units per liter done at least 4-8 weeks post-immunization or documentation of HBV IgG (5,8).

AII

OH should consider all HCWs to be susceptible to HCV even with laboratory documentation of previous infection since infection with one genotype of virus is not protective against infection with another genotype. *However*, an HCV-infected HCW does not require post-exposure testing for HCV.

AIII

OH should consider all HCWs to be susceptible to HIV even with laboratory documentation of previous infection since infection with one genotype of virus is not protective against infection with another genotype. *However*, an HIV-infected HCW does not require post-exposure testing or prophylaxis for HIV.

AIII

OH should refer the exposed HCW for clinical management that may include:

- immunization with hepatitis B vaccine unless contraindicated (5,8);
- administration of hepatitis B immune globulin preferably within 48 hours of exposure (5,8);
- administration of prophylactic anti-retroviral drugs against HIV, as soon as possible and preferably within 1-2 hours (8);
- reassessment and management of HCWs already infected with HCV or HIV;
- see *An integrated protocol to manage health care workers exposed to bloodborne*

pathogens (8).

AIII

OH should refer exposed pregnant HCWs to their physicians for clinical management promptly, particularly regarding the decision to start post-exposure prophylaxis for HIV. This decision should be made in consultation with an HIV specialist.

AIII

OH should arrange for ongoing follow-up management/testing (8).

BIII

OH should refer HCWs with significant dermatitis for clinical management (434).

BIII

There are no modifications to work practices or work restrictions for HCWs exposed to bloodborne pathogens.

OH, as a part of the safety team, should ensure investigation of the work site has been reviewed and discussed in regards to specific procedure/equipment/behavior/issues and preventive action recommended (35).

AIII

OH should ensure that Emergency Responders are included in identification of exposed HCWs and that Public Health is notified in a timely manner regarding testing and post-exposure management. See *A national consensus on guidelines for establishment of a post-exposure notification protocol for emergency responders* (13,73-75) BC [ ], Sask [ ].

BIII

2.2.4.2. HCW Symptomatic/Infected with a Bloodborne Pathogen

OH should refer HCWs who are symptomatic or infected with HBV, HCV or HIV for confirmation of diagnosis and for clinical management that may include laboratory investigation and treatment with antivirals, antiretrovirals (HBV, HCV or HIV), and other current treatments (3,8,435).

AI

OH should refer pregnant HCWs who are symptomatic or infected with HBV, HCV or HIV to their physicians for clinical management in consultation with an Infection Disease specialist.

BIII

OH should refer HCWs infected with hepatitis B "e" antigen and who perform exposure-prone procedures for clinical management and individual assessment. See *Proceedings of the consensus conference on infected health care workers: risk of transmission of bloodborne pathogens* (6).

AIII

OH should refer HCWs infected with hepatitis B without "e" antigen, hepatitis C and HIV and who perform exposure-prone procedures for clinical management and individual assessment to determine work modifications. See *Proceedings of the consensus conference on infected health care workers: risk of transmission of bloodborne pathogens* (6).

AIII

OH should exclude HCWs infected with hepatitis B who test positive for hepatitis B "e" antigen and who perform exposure-prone procedures until clinical assessment is complete and appropriate work modifications are determined (6).

AIII

There are no modifications to work practices or work restrictions for HCWs infected with HBV, HCV or HIV providing they do not perform exposure-prone procedures (6).

OH should assess HCW immunocompromised from HIV for fitness to work; assess type of patient since the HCW should not be exposed to infectious tuberculosis (12) and certain other infections.

BIII

2.2.4.3. OH Management of a Bloodborne Pathogen Outbreak

OH should investigate the possibility of an outbreak if more than one HCW or patient on the same unit meets the criteria for diagnosis for HBV, HCV or HIV.

AIII

OH should liaise with Infection Control /Public Health if an outbreak is suspected.

AIII

2.2.4.4. OH Reporting to Public Health of a HCW with a Bloodborne Pathogen Infection

OH should report a case or suspected/confirmed outbreak of HBV, HCV or HIV to Public Health authorities as required by legislation.

3. Education to HCWs about Prevention and Management of Exposure to or Infection with Bloodborne Pathogens

OH should design education specific to bloodborne pathogens according to recommendations outlined in Section A-III and the:

- hazards and magnitude of the risks associated with bloodborne pathogens (72).
- safety and effectiveness of immunization with hepatitis B vaccine.
- differing risks for bloodborne pathogen exposures present in the various jobs in the workplace.
- need for prompt first aid procedures and prompt reporting to designated personnel (8).
- risk assessment of the exposure and the importance of starting post-exposure prophylaxis for HIV and HBV as quickly as possible, preferably within 1-2 hours (8).
- results of needlestick injury surveillance and prevention strategy outcomes (436).
- benefits of needlestick prevention devices (32,33,420).
- benefits of communication and safety zone in the operating room (35,437).
- risks associated with dermatitis (434).
- incorporation of practices previously called universal precautions (UP) and bloodborne pathogen precautions into Canada's *Infection Control Guidelines: routine practices and additional precautions for preventing transmission of infection in health care* (1).

AIII

OH should liaise with Educational Services and Infection Control to perform or facilitate training on the:

- use of safer techniques involving organization/coordination of the environment, e.g. location of sharps disposal containers which have been proven to be effective in reducing the risks for exposure (7,438);
- use of specific needlestick-prevention devices with opportunity to operate the device (72);
- ability of the HCW to choose and utilize the most appropriate personal protective equipment (420);
- modifications of procedures intrinsically associated with occupational risks (7,35,68);
- surgical procedure techniques to medical students on plastic models and cadavers (76).

AIII

OH should liaise with Education Services and Infection Control to distribute information on the prevention of blood and body fluid exposures in a variety of ways (34), including:

- distribution of educational memoranda, e.g. paycheck enclosures and posting of educational materials;
- publishing notices in the hospital newsletter (431);
- special exhibits during Occupational Health and Safety week;
- bloodborne pathogen pocket cards for instructions in the event of a bloodborne

pathogen exposure (439).

AIII

4. Evaluation of The OH Program to Prevent And Manage Exposures to Bloodborne Pathogens

OH should implement ongoing evaluation of the strategies to prevent exposures to bloodborne pathogens by means of but not limited to the following indicators:

- the percentage of health care workers who are immunized against hepatitis B
- the outcomes for needlestick and other sharps reduction policy
  - Rates of all percutaneous injuries including time, type of work, task of HCW, device, procedure
  - Use of sharps prevention technology
  - Product evaluation pre- and post-implementation
  - Impact of hands-on training programs for use of sharps prevention technology
  - Impact of risk reduction strategies
  - Impact of work modifications for risk reduction which do not compromise patient safety
  - Cost effectiveness of safer equipment
- the rates of exposure to bloodborne pathogens involving mucous membrane and non-intact skin.
- findings of worksite evaluations [7882].

AIII

OH should evaluate participation in the Canadian Needle Stick Surveillance Network (see Appendix IV).

BIII

Section C: Health Care Worker Immunization and Recommendations

The following information is adapted from the Health Canada, Canadian Immunization Guide, 1998 (5)or newly published National Advisory Committee on Immunization (NACI) recommendations that were not included in the 1998 Canadian Immunization Guide. Recommendations which differ from the National Advisory Committee on Immunization (NACI) are based on current literature and the consensus of the working committee for this guideline and will be clearly indicated in the chart.

Hospital employees, students in health care disciplines, laboratory workers and other health care personnel are at risk of exposure to communicable diseases because of their contact with patients or material from patients with infections, both diagnosed and undiagnosed. Maintenance of immunity against vaccine-preventable diseases is an integral part of an occupational health program. Optimal usage of immunizing agents will not only safeguard the HCWs but may, in some instances, also protect patients from becoming infected by employees. In certain circumstances, family members should also be considered as HCWs, since they provide a significant and growing amount of care and because in-home transmission of infectious disease is recognized.

The immunization status of each worker should be assessed at the time of initial employment. A full vaccination history should be elicited and efforts made to obtain documentation of the doses received and dates of administration. Persons who cannot provide acceptable information or evidence of adequate immunity should be offered immunization at the earliest opportunity. Records of all immunizations and serologic tests should be kept by both employer and employee and a recall system for boosters instituted.

Immunization policies at individual health care settings will vary, and decisions about which vaccines to be included should take account of the size and nature of the settings, the exposure risks for the HCW and the nature of employment. It is important to include increased acceptance of vaccinations as an educational objective in employee in-service as well as increased awareness of illness or symptoms that require evaluation.

Readers are encouraged to refer to Section B for details regarding management of HCWs exposed to or infected with a specific vaccine preventable disease.

Recommendations

1. Review immunization history at preplacement exam.

2. Consider immunization against hepatitis B, influenza, measles, mumps, rubella and varicella as priorities because of the greater risk of exposure to and transmission of disease by HCWs (115).

3. Consider measles, rubella, mumps, hepatitis B and varicella immunity as a condition of employment for new employees for new employees.

4. Consider annual influenza immunization as a condition of employment for employees

working in long term care settings (146).

5. Refer susceptible immunocompromised HCWs to their physicians for consideration of immunization.

6. Provide immunization as recommended in the chart that follows unless HCW is immune or contraindications apply.

Vaccine	Consider HCWs Immune/Susceptible	Immunization Recommendations
Diphtheria	• all susceptible because immunization may not be fully protective (102)	NACI recommends: • all HCWs have a complete primary series of 3 doses of a combined tetanus and diphtheria (Td) preparation (5,102) • booster doses of Td every 10 years for HCWs (5) or at a minimum, at least once as an adult e.g. at age 50 if it has been 10 years or more since the last booster (5,102,113)
Hepatitis A	• immune with evidence of hepatitis A immunization or documentation of HAV IgG (5)	NACI does not recommend routine immunization of HCWs, including foodhandlers; consider in institutions for the developmentally challenged where there is an ongoing problem with HAV transmission (5,322)
Hepatitis B **Hepatitis B Cont'd**	• immune with evidence of 3 doses hepatitis B vaccine given at 0, 1 and 6 months and one documented adequate antibody titre of equal to or greater than 10 international units per litre done at least 4-8 weeks post-immunization or documentation of HBV IgG (5)	NACI recommends: • for all susceptible HCWs who may be exposed to blood, blood products, or body fluids or who may be at increased risk of sharps injury, bites or penetrating injuries, e.g. staff of institutions for the developmentally challenged receive a complete 3-dose series of hepatitis B vaccine (5) Post-immunization serologic testing for hepatitis B surface antibody be conducted on all immunized *HCWs 4-8 weeks*, or at least within 6 months after the third dose to determine if immune (5,8) Non responders should be immunized with a second 3-dose series of hepatitis B vaccine and serologic testing repeated (5) Non responders who have received 2 complete 3-dose series of hepatitis B vaccine should be considered susceptible to hepatitis B virus indefinitely. Further hepatitis B immunization is unlikely to create immunity (5) (8) Routine booster doses of hepatitis B vaccine are not recommended for HCWs

Vaccine	Consider HCWs Immune/Susceptible	Immunization Recommendations
		(5,358)
Influenza	All susceptible because strains change annually, the immunization has an efficacy of about 70%, it has a short protective period of about 6 months and the vaccine components change annually (5)	NACI recommends: • annual influenza immunization *only* for HCWs who have significant contact with individuals in high risk groups. Such personnel include physicians, nurses, and others in both hospital and outpatient settings; HCWs of chronic care facilities who have contact with residents; providers of home care, visiting nurses or volunteers, and household members of persons at high risk (5,130) *However*, all HCWs are at greater risk of exposure to and transmission of influenza to high-risk individuals. *Therefore irrespective of whether HCWs have direct contact with high-risk individuals;* • annual influenza immunization should be offered to *all* HCWs (133,135,140,141)
Measles **Measles cont'd**	• immune if born before 1970 or if born in 1970 or after with evidence of: - 2 doses of live measles-containing vaccine or - physician-diagnosed measles or - documentation of measles IgG. (5,147,153,154,162)	NACI recommends: Immunization for persons born in 1970 or after with 2 doses of live measles-containing vaccine given as measles, mumps, rubella (MMR) at least one month apart (5,115,147,153,154,156,157) (161,205) Ensure a second dose of measles vaccine (MMR) is given to HCWs who have previously received only one dose, to provide optimal protection (161)

Refer to Section D for details regarding management of HCWs exposed to or infected with a specific vaccine-preventable disease.

Vaccine	Consider HCWs Immune/Susceptible	Immunization Recommendations
	(161)	
Meningococcus		NACI does not recommend routine immunization of HCWs (5)
Mumps	• immune if born before 1970 or if born in 1970 or after with evidence of: - 1 dose of live mumps-containing vaccine or - physician-diagnosed mumps or - mumps IgG (5)	NACI recommends: Immunization for persons born in 1970 or after with a single dose of live mumps vaccine given as measles, mumps, rubella (MMR)(147,176,178) (5,159)
Pertussis	All susceptible since immunity wanes and there are no recommended boosters for adults (191,192)	NACI does not recommend immunization with whole cell vaccine for persons older than 7 years of age because adverse reactions may be more common and disease is typically less severe than in young children (5) Study of the new acellular vaccine regarding safety, immunogenicity and efficacy in adults is in progress. Although acellular vaccine is now licensed for adults and can be used instead of tetanus-diphtheria (Td) vaccine in adults who have to be protected against diphtheria and tetanus, safety data is lacking for more than one dose. Until the use in adults is clarified and guidelines are published NACI does not recommend immunization of adults with acellular vaccine for universal use or as part of tetanus-diphtheria boosters (5,194)
Polio	• immune with evidence of completed primary series of poliovirus vaccine (oral	NACI recommends: • all persons have a complete primary series of 3 doses of either oral polio vaccine or inactivated polio vaccine. *However*, HCWs should receive only inactivated

Vaccine	Consider HCWs Immune/Susceptible	Immunization Recommendations
Polio con't	or inactivated) (5)	polio vaccine as the use of live-virus vaccine may cause fecal shedding and inadvertently expose immunocompromised patients to live virus (5) Booster doses of polio vaccine are not recommended (5)
Rabies	Susceptible unless have evidence of a completed series of rabies vaccine and appropriate booster doses to maintain an adequate antibody titre (5)	NACI does not recommend routine immunization of HCWs; vaccine should be considered for laboratory workers in specialized reference or research facilities who handle live rabies virus (5)
Rubella **Rubella cont'd**	• immune with evidence of: - one dose of live rubella-containing vaccine or - documentation of rubella IgG (5)	NACI recommends: • immunization *only* for female HCWs of childbearing age without documented immunity and susceptible HCWs of either sex who may through frequent direct face-to-face contact expose pregnant women to rubella (5) *However*, all HCWs may expose and transmit rubella to pregnant females. *Therefore, irrespective of NACI recommendations*; • immunize all susceptible HCWs with a single dose of live rubella- containing vaccine given as measles, mumps, rubella (MMR) vaccine (200-203,207) (205) Vaccine should not be administered to susceptible female HCWs during pregnancy due to the theoretical risk of the rubella vaccine causing adverse consequences to the fetus. Vaccine should be offered post- partum if not provided by the physicians after delivery (5) Female HCWs of child-bearing age should avoid pregnancy for one month after immunization (5)

Refer to Section D for details regarding management of HCWs exposed to or infected with a specific vaccine-preventable disease.

Vaccine	Consider HCWs Immune/Susceptible	Immunization Recommendations
Tetanus	• immune if evidence of completed primary series of tetanus vaccine and booster doses at 10 year intervals (5)	NACI recommends: • all HCWs have a complete primary series of 3 doses of a combined tetanus and diphtheria (Td) preparation (5,102) • booster doses of Td every 10 years for HCWs (5) or at a minimum, at least once as an adult e.g. at age 50 if it has been 10 years or more since the last booster (5,102) • booster dose of Td should be considered in the event of a tetanus-prone wound (5,102)
Typhoid		NACI does not recommend routine immunization of HCWs; vaccine should be considered for laboratory workers in specialized reference or research facilities who frequently handle cultures of Salmonella typhi (5)
Varicella **Varicella con't**	• immune with evidence of: - self reported history of varicella or zoster or - physician-diagnosed varicella or zoster or - documentation of VZVIgG or - 2 doses of varicella vaccine, given at least one month apart (4,290,295)	NACI recommends: • all susceptible HCWs be immunized with 2 doses of live varicella vaccine, given at least one month apart (for adults) (4,295) Vaccine should not be administered to susceptible female HCWs during pregnancy (4,295) Female HCWs of child-bearing age should avoid pregnancy for one month after immunization (295) Booster doses of varicella vaccine are not recommended (295)

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Refer to Section D for details regarding management of HCWs exposed to or infected with a specific vaccine-preventable disease.

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Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
Adenovirus (Epidemic Kerato-conjunctivitis)	Direct or indirect contact of ocular mucous membranes with infectious eye secretions.	No	No	I – Yes See p.
Bloodborne Pathogens	A percutaneous injury from equipment contaminated with blood or body fluids* or mucous membrane or non-intact skin contact with blood or body fluids*. Blood on intact skin is not an exposure. See *An integrated Protocol to Manage Health Care Workers Exposed to Bloodborne Pathogens* (8)	See p.	See p.	See p.
- HBV		Yes	S/I – Yes	S/I – Yes – "e" antigen positive doing exposure-prone procedures
- HCV		No	S/I – Yes	S/I – Yes – "e" antigen positive doing exposure-prone procedures
- HIV		Yes	S/I – Yes	S/I – Yes – "e" antigen positive

Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
	* See p.	See p.	See p.	doing exposure-prone procedures See p.
Creutzfeldt-Jacob Disease (CJD)	Refer to *Infection Control Guidelines for Creutzfeldt-Jakob Disease (CJD) in Canada* (In Press) (2)	No	No	?
Cytomegalovirus (CMV)	Direct contact of mucous membrane with infectious saliva, genital secretions or urine.	No	No	No
Diphtheria	Droplet contact of HCWs oral, nasal or conjunctival mucous membranes with oropharyngeal secretions infected with a toxigenic strain of *C. diphtheria;* direct contact of non-intact skin or mucous membranes with drainage from skin lesions infected with a toxigenic strain of *C. diphtheriae.*	Yes See p.	C/S/I – Yes See p.	E – Yes C/S/I – Yes See p.
Epstein Barr Virus (EBV)	Direct or indirect contact of oral mucous membranes with infectious saliva.	No	No	No

Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
Gastroenteric Infections	Having direct or indirect oral contact with infectious feces; exposure may also occur with ingestion of contaminated food or water.	No	S/I – Most No dependent on etiology See p.	S/I – Yes See p.
Hepatitis A Virus (HAV)	A non-immune person having direct or indirect oral contact with infectious feces; exposure may also occur with ingestion of contaminated food or water.	Yes See p.	No	S/I – Yes See p.
Hepatitis E Virus (HEV)	A non-immune person having direct or indirect oral contact with infectious feces; exposure may also occur with ingestion of contaminated food or water.	No	No	S/I – Yes See p.
Herpes Simplex Virus (HSV)	Direct or indirect contact of non-intact skin or mucous membranes with infectious oral or genital secretions, lesion drainage, amniotic fluid or any neonatal secretions or excretions.	No	S/I – Yes See p.	S/I – Yes See p.
Influenza	Droplet or indirect contact of oral, nasal, or conjunctival mucous membranes with infectious respiratory secretions.	Yes in outbreak See p.	S/I – Yes See p.	E – Yes in outbreak S/I – Yes See p.
Malaria	N/A	No	S/I – Yes Consult Public Health	No

Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
Measles	A non-immune HCW spending anytime in an enclosed airspace, i.e. same room or face-to-face contact with an infectious patient in an open area or being in a room supplied by a ventilation system that recirculates contaminated air within 2 hours of an infectious patient being there within the 5 days before to 4 days after the onset of the rash.	Yes See p.	No	E – Yes S/I – Yes See p.
Meningococcus	Direct contact of HCWs oral mucous membranes during mouth-to-mouth resuscitation or resulting from a spray of infectious oral or nasopharyngeal secretions (174) within 7 days of onset and up to 24 hours after start of effective th -apy.	Yes See p.	S/I – Yes See p.	S/I – Yes See p.
Mumps	Direct or droplet contact of oral, nasal, or conjunctival mucous membranes of a non-immune HCW with infectious saliva during the 2 days before and up to 9 days after the onset of parotid swelling.	No	No	E – Yes S/I – Yes See p.
Parvovirus B19	A non-immune HCW having direct or droplet contact of oral, nasal or conjunctival mucous membranes with infectious respiratory secretions.	No	No	No
Pediculosis	To head lice as direct or indirect hair-to-hair contact with a patient infested with head lice; body lice exposure is defined as direct skin-to-skin contact or skin contact with clothing or bedding of an infested person prior to 24 hours of effective treatment. Crab lice transmission is not applicable in an OH setting.	No	S/I – Yes See p.	S/I – Yes See p.

Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
Pertussis	Face-to-face contact greater than 5 minutes with an infectious individual or sharing the same confined air space, i.e being within one metre of an infectious individual for greater than 1 hour(192).	Yes See p.	S/I – Yes See p.	E – Yes if no prophylaxis S/I – Yes See p.
Rabies	A non-immune HCW having a bite from a patient or animal with rabies; direct contact of non-intact skin or mucous membranes with saliva, cerebrospinal fluid or brain tissue from a patient or animal with rabies, by inhalation of aerosolized virus in a laboratory.	Yes – Consult Public Health	No	N/A
Respiratory Infections	Droplet or indirect contact of oral, nasal or conjunctival mucous membranes with infectious respiratory secretions.	No	S/I – Most No-dependent on etiology	S/I – Yes See p.
Rubella **Congenital Rubella Syndrome (CRS)**	Direct or droplet contact of the non-immune HCWs oral, nasal or conjunctival mucous membranes with infectious respiratory secretions during the period from 7 days before onset of symptoms to 7 days after symptoms appear. A non-immune HCW having droplet, direct or indirect contact of oral, nasal or conjunctival mucous membranes with the nasopharyngeal secretions or urine of an infant with congenital rubella syndrome.	Yes See p.	No	E – Yes S/I – Yes See p.
Scabies – Typical	Direct skin-to-skin contact with an infested patient before treatment or until 24 hours of effective treatment.	No	S/I – Yes	S/I – Yes

Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
Scabies-			See p.	See p.
Typical con't	Minimal direct or indirect contact with an infested person before treatment or until 24 hours of effective treatment. Only minimal contact is required because of the large number of mites present on the source.	Yes	S/I – Yes	E – Yes S/I – Yes
-		See p.	See p.	See p.
Norwegian				
Staphylococcus aureus	Direct or indirect contact of non-intact skin or mucous membranes with MSSA infected body sites, wound drainage or respiratory secretions.	No	S/I – Yes C- Yes if epidemiologi-cally linked to transmission	S/I – Yes C – Yes if epidemiologi-cally linked to transmission
A) Methicillin-sensitive (MSSA)			See p.	See p.
B) Methicillin-resistant (MRSA)	Direct or indirect contact of non-intact skin or mucous membranes with MRSA colonized or infected body sites, wound drainage or respiratory secretions.	No	C/S/I – Yes	C/S/I – Yes
			See p.	See p.
Streptococcus – Group A (GAS)	Droplet, direct or indirect contact of oral, nasal or conjunctival mucous membrane or as direct contact of non-intact skin with infectious respiratory or wound secretions from individuals with necrotizing faciitis, toxic shock syndrome, meningitis, pneumonia or any form of GAS that results in death, within 7 days prior to the onset of GAS and until 24 hours of effective antibiotic therapy.	Variable - for invasive disease only by Provincial guidelines See p.	S/I – Yes C – Yes if epidemiologi-cally linked to transmission	S/I – Yes C – Yes if epidemiologi-cally linked to transmission
			See p.	See p.

Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
Tinea	Direct or indirect skin contact with infectious skin or scalp lesions or contaminated environmental surfaces.	No	S/I – Yes See p.	S/I – Yes See p.
Tuberculosis	Refer to *Infection Control Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings* (12); *A National Consensus on Guidelines for Establishment of a Post-Exposure Notification Protocol for Emergency Responders* (13) *Canadian Tuberculosis Standards – Fourth Edition*; (278); related provincial recommendations.	Yes	S/I – Yes	I – Yes if infectious pulmonary TB
Typhoid	A non-immune person having direct or indirect oral contact with infectious feces; exposure may also occur with ingestion of contaminated food or water.	No	C/S/I – Yes See p.	C/S/I – Yes See p.
Vancomycin Resistant Enterococci (VRE)	Direct or indirect contact of hands or skin with feces, urine, wound drainage or areas of colonized skin of an infected or colonized patient.	No	C/S/I – Yes	S/I – Yes if symptomatic C – Yes if epidemiologi-cally linked to

Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Disease	Exposure Definition	Prophylaxis for E	Treatment for C/S/I	Work Restrict for E or C/S/I
VRE con't			See p.	transmission See p.
Varicella Zoster Virus (VZV) **A) Varicella (chicken pox)**	A non-immune HCW inhaling airborne virus from an infectious patient, having face to face contact with an infectious patient, spending one hour in the room with an infectious patient or by direct or indirect contact of oral, nasal or conjunctival mucous membranes with vesicle fluid or respiratory secretions from an infectious patient 2 days before onset of symptoms and until all lesions have crusted over.	Yes See p.	S/I – Yes See p.	E – Yes S/I – Yes See p.
B) Herpes Zoster (Shingles)	Direct or indirect contact of oral, nasal or conjunctival mucous membranes of a non-immune HCW with vesicle fluid of an infectious patient; additionally define HCW exposure to disseminated herpes zoster as a non-immune HCW being in an enclosed airspace with an infectious patient, e.g. same room, or having face-to-face contact with an infectious patient(4).	Yes See p.	Yes See p.	E – Yes S/I – Yes See p.
Viral Hemorrhagic Fever (VHF)	Refer to *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases*, 1997 (11).	No	S/I – Yes	S/I – Yes

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Legend: E – Exposed, C/S/I – Colonized / Symptomatic / Infected

Appendix I: Guideline Evidence Based Rating System

I. Current Rating system for Statements

In the past five categories have ranked the strength of evidence *for* (categories A-B), *neutral* (C), or *against* (D-E) a statement and three grades to describe the quality of supportive studies (30). This format uses an evidence-based medicine approach that stresses the examination of evidence from clinical research, well designed experimental and observational studies, and places less emphasis on intuition and recalled experiences.

To simplify and clarify the statements categories A, B, and C will be used to support a recommendation for or against use in this document. For Category C, the word "insufficient" replaces "poor". The quality of evidence will continue to have the same grades. This system is outlined in Table III:

Table III: Strength and Quality of Evidence for Recommendations

Categories for strength of each recommendation	
CATEGORY	DEFINITION
A	Good evidence to support a recommendation for or against use.
B	Moderate evidence to support a recommendation for or against use.
C	Insufficient evidence to support a recommendation for or against use.
Categories for quality of evidence	
GRADE	DEFINITION
I	Evidence from at least one properly randomized, controlled trial.
II	Evidence from at least one well-designed clinical trial without randomization, from cohort or case-controlled analytic studies, preferably from more than one centre, from multiple time series, or from dramatic results in uncontrolled experiments.
III	Evidence from opinions of respected authorities on the basis of clinical experience, descriptive studies, or reports of expert committees.

When regulations are quoted no rating is given as it is a legislative requirement.

Appendix II: Evaluation of Risk

Once data are collected from exposure assessments, screening, and treatment of exposed and /or infected HCWs, then the level of risk should be evaluated. Three factors are necessary to assess the level of risk from exposure to the hazard. The first one is the potential consequence of the hazard, the second one is the likelihood of exposure to the hazard, and the third one is the number of persons exposed regularly to the hazard. Information from the three evaluations enables estimation of the risk (23).

Evaluate the potential consequence of exposure to the hazard:

Level I: catastrophic hazard - could cause death.
Level II: critical hazard - could cause a severe injury or occupational illness
Level III: marginal - would cause minor injury or minor occupational illness that results in lost workdays.
Level IV: negligible - would not affect personnel safety or health and would result in loss of less than a workday but still remains a safety violation.

Rank the hazard by risk by consequences (severity) and the probability (frequency) of exposure to the hazard:

Level I: infection from the hazard is likely to occur immediately or within a short period of time after exposure
Level II: infection will probably occur in time
Level III: may possibly occur in time
Level IV: unlikely to occur

Rank the hazard by risk to the number of persons regularly exposed:

Level I: more than 50 persons regularly exposed to the hazard
Level II: 10 - 49 persons are regularly exposed to the hazard
Level III: 5 - 9 persons regularly exposed to the hazard
Level IV: less than 5 persons are regularly exposed to the hazard

By ranking the consequence, severity, frequency, and exposure a risk assessment can be given from 1) critical 2) serious 3) moderate 4) minor, and 5) negligible.

Alternatively, some institutions use the formula that follows to estimate the risk score (28). Rank the hazard by exposure.

R = S X E X P

where R = risk score, S = severity, E = exposure, and P = probability. Each variable is assigned a value from 1 to 5 and then the potential severity from the exposure is ranked.

Using either method, once the estimation of the hazard's risk is completed, **priorities are set** to reduce the risk of specific exposures by one or more of the risk control measures that follow.

APPENDIX III: BLOODBORNE PATHOGEN EXPOSURES TO HEALTH CARE WORKERS

Appendix III describes details related to sharps injuries and mucocutaneous splashes to HCWs and the effectiveness of control measures.

1. Efficiency of Transmission of Bloodborne Pathogens

Hepatitis B is transmitted more efficiently than hepatitis C and both are transmitted more efficiently than HIV as is demonstrated in Table IV:

Table IV: EFFICIENCY OF TRANSMISSION OF BLOODBORNE PATHOGENS

TYPE	HIV	HBV	HCV
Risk of Transmission Following Needlestick Exposure	0.3 % (364,410) [4971 1390 1321 561 1319 3002]	19- 40%, if HCW non-immune and the source is hepatitis B "e" antigen positive (358) [2970 1308 1487] 1-6% if HCW is non-immune and the source is hepatitis B "e" antigen negative (358) [1300 2970]	1.8% (0-7%) [1923] (358) 10% [1367] 0.45% (77)
Risk of Transmission Following Mucous Membrane Exposure	0.09 % (364,410)		0.36% (77)
Risk of Transmission Following Non-Intact Skin Exposure	< 0.09% (440)		

2. Occupational Groups at Risk of Exposure/Transmission to Blood and Body Fluids

It is difficult to compare rates of exposures to blood and body fluids by specific groups of HCWs, as there is no standardized denominator. Various reports include injuries per 100 full time employees, per 1,000 patient days, or per 100,000 procedures (56,370). Data from the 70 hospital Exposure Prevention Information Network database indicate that the average rate of reported sharp object injuries is 30/100 occupied beds per year (54).

Nurses are the largest HCW group and many studies report that they receive the most percutaneous injuries. Phlebotomists are a smaller group with only 1/20 the number of nurses. However, phlebotomists have 39% as many documented seroconversions to HIV as nurses, making them a higher risk group for work-related bloodborne pathogen infections (431,441). Some studies indicate that physicians may have a higher rate of injuries than nurses but the injury is not reported (31). Details of the studies of percutaneous injuries including two groups at risk, nurses and students, follow.

2.1 Nurses receive the most percutaneous injuries in Canada

In a Winnipeg study for the calendar year 1990, Yassi reported occupational exposures indicating nurses received 82% of the injuries; laboratory personnel 6.2%; housekeeping, laundry, central supply, and maintenance 5.7%; interns, residents and medical students 3%; and respiratory and radiology technologists 3% (370). These percentages are similar to a previously conducted study (39). Some workers, e.g. in the laundry do not require the use of sharps making their injuries all due to the careless handling and disposal of sharps by others. When rates are examined, nurses in medicine had the highest rate of injury (14.23/100,000 hours worked) followed by nurses on the intravenous team, blood bank employees, and total parenteral nutrition nurses (10.09/100,000).

A Montreal acute care hospital study of three large university affiliated hospitals and two community hospitals in 1991-1992 indicated nurses had the highest percentage of exposures to blood and body fluids with 62% of all types of exposures; 77% of all needlesticks. Other recipients of injuries included nursing assistants with 7% of all exposures, licensed practical nurses 5%, housekeepers 5%, clinical laboratory technicians 4.5%, nursing students 3.4%, and radiology technicians 2.5%. When rates of exposures to blood and body fluids per full time employee per year were examined, nurses had 18; licensed practical nurses, 12; radiology technicians, 10; clinical laboratory technicians, 8; and nursing assistants and housekeeping staff, 6 (66).

A non-hospital study, in community service centres and home care that was conducted in Montreal from 1992 to 1993 indicated 80% of all exposures to blood and body fluids were to nurses and 92% of all needlestick injuries to nurses (355).

Community nurses may be at an increased risk for injury when compared with hospital workers as they are less able to control the work environment. Poor lighting, furniture that cannot be adjusted, and working alone with clients who may be confused enhances the likelihood of sharps injuries in the home (31)[6417].

The Canadian *National surveillance of occupational exposure to the Human Immunodeficiency Virus* reports worker-documented parenteral, mucous-membrane or direct contact to non-intact skin exposure to HIV positive blood. Nurses have 70% of all reported exposures to HIV from needlestick injuries. Table V is as of October 1, 1999 and demonstrates documented HIV exposures by occupational group and type of injury since 1985 (351).

Table V: Exposures by Occupation Group

	Nurse			Therapist/ Technician			Student/ Resident			Laboratory Technician			Physician			Other			Total	%
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C		
NeedleStick	321	75%	66%	16	4%	47%	21	5%	78%	27	6%	47%	26	6%	62%	17	4%	40%	428	62%
Surgical Instrument wound	18	47%	4%	1	3%	3%	3	8%	11%	6	16%	10%	4	11%	10%	6	16%	14%	38	6%
Mucous membrane	46	62%	10%	8	11%	24%	2	3%	7%	9	12%	16%	5	7%	12%	4	5%	10%	74	11%
Skin contact	0	0%	0%		0%	0%	0	0%	0%	0	0%	0%	0	0%	0%	0	0%	0%	0	0%
a) Intact	5	36%	1%	1	7%	3%	0	0%	0%	2	14%	3%	2	14%	5%	4	29%	10%	14	2%
b) Non-intact*	60	67%	12%	5	6%	15%	1	1%	4%	12	13%	21%	5	6%	12%	7	8%	17%	90	13%
c) unknown	34	79%	7%	3	7%	9%	0	0%	0%	2	5%	3%	0	0%	0%	4	9%	10%	43	6%
Total	484			34			27			58			42			42			687	100%
% of total injuries	70%			5%			4%			8%			6%			6%			100%	

* Previous tables had a separate heading called 'Open Wound Contamination' which has now been combined with 'Nonintact Skin Contact' exposures.

A = number of injuries

B = % of this type of injury compared with all injuries for this category of worker

C = % of this type of injury for this worker category compared with all worker's injuries of this type

Source: National Surveillance of Occupational Exposure to the Human Immunodeficiency Virus (HIV)
Division of HIV Epidemiology, Bureau of HIV/AIDS, STD & TB, LCDC, HPB, Health Canada

Date: October 1, 1999

2.2 Nurses receive the most percutaneous injuries in the United States

In one of the first comprehensive studies of needlestick injuries at the University of Virginia Hospitals in the U.S., the most frequent needlestick injuries occurred to nurses and nursing students (64%), personnel in radiology and respiratory therapy (20%), housekeeping personnel (8%), and physicians and medical students (3%) (29).

In 1997, a United States study of 77 hospitals (2/3 community hospitals and 1/3 teaching hospitals) reporting to the Exposure Prevention Information Network over a 3 year period found the most frequent injuries occurred to nurses (51%), who perform many procedures with syringes and needles (about 18% filled with blood), and phlebotomists (19%), who withdraw blood (a higher risk activity as the needle or catheter is filled with blood) (442).

A study conducted in a university and community hospital indicates ambivalence on the part of the user regarding responsibility for safe disposal of sharps (443).

2.3 Students are at higher risk for injuries in Canada

Students in health care are at risk of exposure to bloodborne pathogens but the rates vary considerably:

A Canadian study of needlestick injuries demonstrated that ward related injuries were highest in final year medical students (0.97/person year) and decreased to 0.42/person year for third year residents. Those with no ward related injury in the first year were at 14% risk of injury in subsequent years. Those with at least one injury had an average risk of injury in the subsequent year of 54%. Seventy-six percent of medical and all surgical house staff had sustained at least one injury by the end of their internship (444). Forty-five percent of surgical staff (1.4/person year) were injured in their student year whereas 3.7/person year were injured as interns and 5.4/person year were injured as residents (444).

Yassi, in Winnipeg, found that nursing students received 3.5% or 9.03/100,000 of reported occupational exposures in 1990 (370).

In a Montreal hospital study, nursing students received 3% of the exposures to blood and body fluids (66).

Canadian health care students reporting to the *National surveillance of occupational exposure to the Human Immunodeficiency Virus* received 4% of the injuries (351).

2.4. Students are at risk for injuries in the United States

Thirty-three percent of responding fourth year US medical students sustained one or more sharp injury during their clinical training over a 10 month period. Sixty-nine of the injuries were in surgery (60% in the operating room and 34% in patient rooms). Seventeen percent of the injuries were caused by hollow-bore, blood-filled needles (76).

A 1998 study of respondents in half of all U.S. dental schools, indicated that third and fourth year dental students had 62.5% of the reported exposures although they were only 33.8% of dental HCWs. This represents a rate of 10.6 reported injuries /100 person years (445).

2.5 Dental surgeons in Canada are at increased risk for injuries

Dentists are a group at increased risk of exposures to bloodborne pathogens. Seventy-six percent of dental surgeons had an exposure to blood or body fluids in the previous year according to a recent survey (446).

3. Equipment/devices associated with percutaneous exposures

Many devices used in health care are hazardous (358). In a case-control study by Centers for Disease Control, there was a higher risk of bloodborne pathogen transmission with large, hollow bore devices, e.g. those used to draw venous or arterial blood versus solid devices, e.g. suture needles (353). The hollow bore devices contain undiluted blood that increases the exposure of HIV to the HCW, especially if the person is in the terminal stages of AIDS when the viral titre is high. In this case, the risk of seroconversion is higher than the average risk of 0.3% (353). The risk of transmission of HIV to the HCW was 4.3 times higher if the procedure involved a needle in the artery or vein, e.g. phlebotomy, insertion of an intravenous catheter, or arterial blood gas collection than if the procedure was an intramuscular injection or an injection into an intravenous catheter. The risk of transmission of HIV was 6.2 times higher if there was visible blood on the device. A deep injury, a deep puncture or wound with or without bleeding, was 15 times more likely to transmit HIV than if the injury was superficial (353). The type of device and the procedure involved changes the risk of exposure to bloodborne pathogens and transmission of disease to the HCW. These two factors are important to consider when committees choose safer equipment for their staff.

71% of dental surgeons who responded had a percutaneous injury and/or 45% had a blood mucocutaneous splash. Nineteen percent of the percutaneous injuries were with hollow-borne needles and 22% were to cuts. The remainder of the injuries were to suture needles (67%). Respondents reported a mean of 4.2 percutaneous injuries and 2.2 mucous membrane splashes in the previous year (446).

Many studies give examples of the type of injuries that occur in their work site and how the devices were used. Blood-filled needles especially used for the measurement of blood gases, intravenous catheter stylets, winged steel needles; butterfly needles, and vacuum phlebotomy needles cause the greatest number of injuries in US NASH [ ].

The Exposure Prevention Information Network (EPINet) is one of the largest standardized surveillance databases to contain information from 70 U.S. hospitals about bloodborne pathogen exposures. Thirty six per cent of percutaneous injuries are caused by syringes with a hollow-bore needle but they are not the highest risk device as they are used for intramuscular and subcutaneous injections [5446]. Overall 25% of percutaneous injuries are with blood filled needles and are considered high risk. 74% are related to blood drawing and 26% to intravenous catheter placement [5313]. Examples of hollow-bore needles are described in the Exposure

Prevention Information Network study of 1993-5 in which 17% of the injuries were caused by needles used to start intravenous infusions or set up heparin locks, 13% of injuries were by needles used to draw venous blood, and 3% of injuries were from needles used to draw arterial blood (442).

In Italy the highest risk of exposure is with winged steel needles and intravenous catheter stylets (77).

Needles removed from proximal ports of central venous lines and heparin-locks are more likely to contain occult blood than those from peripheral lines and distal ports of central lines without visible blood (429) and therefore carry a higher risk for transmission of disease.

Accessing the heparin intravenous lock has been associated with increased risk of injury. In a Winnipeg study, this procedure was responsible for 26% of all needlestick exposures (39).

In home care, implanted ports are one of the most commonly used vascular devices (433). The nurse must remove the needle from the port at the end of the infusion therapy and there is unusually high resistance and drag on the needle when it is withdrawn. Since the nurse's hands must stabilize the port during the process and a blood-filled needle is withdrawn from the port the risk of injury is increased (433). Exposure Prevention Information Network data indicates that 48% of injuries using the Huber needle that attaches to the port happen when the needle is withdrawn (433).

While disposable syringes caused the most frequent injuries in a university hospital, devices requiring disassembly had rates of injuries that were five times higher (29).

The rates of injuries per 100,000 devices indicate that vacutainers (413), butterfly needles (407), intravenous catheters (392), and hypodermic needles (447) were most commonly associated with needlestick injuries in the Montreal acute care hospitals (66) and non-hospital study (355).

4. Circumstances Associated With Percutaneous Exposures

Needlestick injuries can occur any time needles are manipulated. Injuries with needles before they are used on the patient are not a risk. Injuries that occur from a needle that was inserted into an intravenous line not related to blood products are usually very low risk injuries.

The needlestick injuries that occur during usage on the patient carry a higher risk and are more difficult to control, e.g. the patient may move suddenly. Needlestick injuries after use are completely preventable with engineering controls such as safer passive devices, e.g. use a safer intravenous catheter to establish the line. Exposures to the same group of workers may differ in varying circumstances altering the risk.

In a study conducted at the University of Virginia Hospitals in 1986, 16% of needlestick injuries occurred before or during use, 70% after use and before disposal (mostly with recapping), and 14% during or after disposal (29).

The following Table VI demonstrates the number of injuries that occurred in the 1993-4 Exposure Prevention Information Network database (422), in the following sequence of usage (not all categories are included) (percentages are approximate):

Table VI: Timing of injury in relation to device used

DEVICE	NUMBER AND % OF INJURIES BEFORE USE	NUMBER AND % OF INJURIES DURING USE	NUMBER AND % OF INJURIES RECAPPING	NUMBER AND % OF INJURIES BEFORE DISPOSAL	NUMBER AND % OF INJURIES PUTTING DEVICE INTO DISPOSAL CONTAINER
Hollow-bore needles *and* Disposable syringes	8 2.5%	54 18%	41 13%	74 24%	28 9%
Hollow-bore needles *and* Arterial blood gas syringes	0	6 33%	2 12%	3 17%	0
Hollow-bore needles on intravenous systems	0	18 18%	0	16 16%	4 4%
Hollow-bore winged steel needles (butterfly)	0	10 23%	1 3%	11 26%	11 26%
Intravenous catheter stylets (tubing stays in vein)	0	6 15%	1 3%	18 46%	3 8%
Vacuum tube/phlebotomy hollow bore needles	1 2.5%	11 23%	2 4%	20 43%	5 11%
Lancets	1 3%	8 22%	0	11 30%	3 8%
Suture needles – Doctors **Nurses**	0 2 – 5%	37 - 90% 9 - 22%	0 0	1 – 2% 5 - 12%	0 2 - 5%
Scalpel blades - Doctors **Nurses**	0 1 - 4%	12 - 60% 0	0 3 – 15%	3 – 15% 4 – 19%	0 1 - 3%

Source: 1993-4 Exposure Prevention Information Network database (422)

In the 14 years in Canada that the *National surveillance of occupational exposure to the Human Immunodeficiency Virus* (351), has been collecting data, 28% of the preventable exposures occurred by recapping, 19% were by improper disposal of a used needle, and 53% were by skin contact, i.e. open wound contamination and non-intact skin contact.

While recapping is no longer permitted in the U.S. due to the Occupational Safety And Health Administration bloodborne pathogen rule, still 14% of contaminated percutaneous injuries in a study of anesthesia personnel were due to recapping in 199* [ ].

Difficulties arise when, e.g. doses of anesthetic drugs may be given sequentially to an individual patient from the same syringe requiring the needle to be recapped often. Sometimes the needle is changed and an injury can be sustained. At the Mount Sinai Hospital in Toronto an opthalmologist sustained an injury to the index finger from an HIV positive patient while changing needles for an anaesthetic injection (448).

Other groups report the circumstances of their injuries. A recent study of fourth year medical students indicated that, in surgery, 34% of injuries were inflicted by another HCW, usually while holding retractors or retracting tissue with their hands (76).

Canadian Dental staff are most likely to be injured in laboratory work, clean-up, and instrument preparation (449). Dental surgeons are at higher risk of percutaneous exposures to bloodborne pathogens if they are a younger age, have a higher work load, work in a community or regional hospital, and do not use "no touch" techniques. A mucocutaneous splash is most likely to occur if the dental surgeons are a younger age, have a higher work load, and do not use eye protection in the clinic or operating room (446).

Exposure to large amounts of blood or body fluids can occur in any work area. In a study of clinical lab workers, 12% of exposures exceeding 5 c.c.'s of blood or body fluids were in the patient rooms but only 1% of similar exposures occurred in the lab (450). As many as 47% of the intravenous catheter injuries occurred in patient rooms compared to fewer injuries in the emergency department, 11%.

5. Underreporting of Exposures by HCWs has been widely documented

A study by Hamory indicated that underreporting of 40% occurred during the 3 months before the survey and that 75% of personnel in a small U.S. university hospital did not report their injuries over the previous year (451).

In 1990, McGeer, Simor, and Low reported that only 5% of final year medical students, interns, and residents at the University of Toronto reported percutaneous injuries (444).

In Montreal, in a five hospital study, anonymous reporting of injuries was compared with the injuries reported to the health service. Thirty-four percent of workers did not report any of their percutaneous injuries and 75.1% did not report mucocutaneous exposures. When the number of reported exposures was compared with the total number of exposures indicated in a questionnaire of the employees, the rate of underreporting was 69.6% for percutaneous exposures and 86.4% of mucocutaneous exposures (452).

The similar Montreal non-hospital study indicated an underreporting rate of 38.5% for percutaneous exposures (355).

When documented injuries in over 70 U.S. hospitals were reported to the Exposure Prevention Information Network database, they were analyzed by the University of Virginia. The results of the analysis were compared with the injury information obtained from the Occupational Health and Safety Administration (OSHA) for the same hospitals. Only 10% of percutaneous injuries and 7% of mucocutaneous injuries that should have been reported by law to OSHA were reported (453).

In the medical schools at the University of Virginia in 1999, a study of fourth year medical students reporting on their experience with exposures to blood and body fluids showed that only 43% of the students with injuries reported them to student health (76).

Nine percent of injuries among phlebotomists, 32% among nurses, 65% among medical students and 69% among residents (medical, pediatric, and surgical) did not report needlestick injuries during the previous year in Minneapolis-St. Paul, New York City, and San Francisco during a 1993-5 study to evaluate safer phlebotomy devices carried out by Centers for Disease Control and six hospitals (431).

A follow-up survey of individual dental students in the 1998 U.S. dental school study indicated 68% did not report percutaneous and mucosal exposures (445).

5.1 Many reasons are cited for underreporting

HCWs do not always realize that they have had an exposure to blood and body fluids. An Australian prospective study indicated that 44% of eye shields used in surgery tested positive for blood but the surgeon was aware of a spray episode in only 8% of the cases (454).

Some of the reasons HCWs give indicate that they consider the event to be a low risk one:

- The injury was not serious (445),
- The patient was healthy (445),
- Denial of the incident, based on fear about HIV status of the source (359).

Other reasons for not reporting are due to the HCW feeling guilty because s/he had an injury:

- Self-blame on the part of the HCW injured (455),
- Perceived loss of status in the workplace or the academic hierarchy (456),
- Concern about job security during a time of downsizing (455).

HCWs doubt the helpfulness of the person/institution to whom s/he reports:

- Perception of carelessness on the part of the employee by the person who takes the report (455),
- Feared problems with confidentiality (445),
- Feared a negative clinical evaluation (445),
- Lack of consistent 'team spirit' support from co-workers (433,456),

- Critical unsupportive attitude by direct management (433,456),
- Lack of support by the larger organizational body (456).

HCWs experienced organizational difficulties or operational procedures:

- Health center was not open at the time of the injury (354),
- The HCW was unaware of post-exposure protocols (457),
- The HCW did not know how to report (354),
- It was too difficult to determine the status of the source (354),
- Method of reporting is more difficult when the injury occurs in the home than in the hospital (31),
- The equipment was faulty or insufficient (456)

- Lack of time (354,359,445)
- Lack of involvement in selecting and evaluating equipment (455)

5.2 Some studies have looked at methods to increase reporting:

The more complete the policies and procedures for post-exposure follow-up, the more injuries are reported (458).

Standardization of post-exposure procedures may increase satisfaction and decrease waiting times so that staff report injuries even if they are busy (459).

In Australia, an educational program, along with the testing of a new safety device, resulted in 26% of needlestick injuries being unreported whereas 64% were not reported before the program (460). The importance of repetition of the educational program was stressed, although it was not a part of this process.

6. Cost of Percutaneous Exposures

Of the many consequences following needlestick injuries, financial cost is a significant one. It includes assessment of the source, lost time from work, post-exposure counselling and assessment, laboratory testing, prophylaxis, follow-up and psychosocial effect.

In 1995, Yassi estimated the cost of a needlestick injury in a Winnipeg hospital, without post-exposure prophylaxis for HIV, to be from $80 - $560 (424).

In 1999 in Canada, the cost for a 28-day course of a triple-drug post-exposure prophylaxis regimen is $1100, including blood test costs (448).

The average cost of a needlestick injury in the United States ranges from $1000 (no AZT) - $2000 (includes AZT) (461). Another estimate states $1500 U.S. for triple therapy (433).

Two of the seventy hospitals in the Exposure Prevention Information Network reporting group, one a community hospital and the other a university hospital, estimated the cost of percutaneous

and mucocutaneous exposures. Mucocutaneous exposures cost about the same amount as percutaneous in each of the two hospitals [6249].

Even when the source individual tests negative for bloodborne pathogens, needlestick injuries have a negative psychosocial impact. Pre-existing stressors, controlled before a needlestick injury, may become evident at the time of injury or cause a delayed response. Both the injury and previous losses can lead the HCW to feel a loss of control and a period of mourning. Many HCWs suffered from depression before the injury and were either in psychosocial therapy or support groups at the time (17%). Eighty-three per cent of depressed HCWs were referred during the post-test counselling session for psychotherapy. Forty-three percent of workers needed psychosocial support when the HIV test results were unknown. This emphasizes the importance of obtaining permission and testing the source. Surprisingly, 32.5% of referrals were for HCWs whose source patients had tested HIV negative. In all, forty-two percent of the 700 workers assessed at the time of pre- or post-HIV testing at the San Francisco General Hospital needed additional professional or peer support (456). The psychosocial effects of the HCW due to a potential exposure to bloodborne pathogens cannot be underestimated.

Safer devices can replace existing equipment without spending extra money. In a Winnipeg study, changes to safer equipment were accomplished with a 0.3% savings [direct or indirect] (424).

A preventive strategy that eliminates 100% of needlesticks, and not costing more than 36% of the cost of needled devices would be cost effective (462).

7. Prevention of Exposures to Bloodborne Pathogens

"Preventable needlesticks" are defined as those that are caused by unnecessary needles or that occur after the use of the device, when a safety feature could protect hands from needles." (463). The device with "engineered sharps injury protection" has a physical attribute that is built into the needle or other sharps device which effectively reduces the risk of a blood or body fluid exposure incident, e.g. devices that blunt, sheath, or withdraw the sharp into the device, shield the hands from the used needle (441).

Up to 85% of needlestick injuries are preventable by education, safer devices, reduction in the use of invasive procedures, a secure work environment, and an adequate staff-to- patient ratio (29,47,442,464). From 1993-1995, 81% of injuries in the Exposure Prevention Information Network database for surveillance of percutaneous injuries in 77 U.S. hospitals were from hollow bore needles. These are potentially preventable injuries (442).

In five large teaching hospitals in the U.S. National Surveillance System for Hospital Health Care Workers for bloodborne pathogen exposures, thirty-three percent of needles used for blood collection were classified as not preventable with the technology that was used [5625] but might be preventable with passive devices.

8. Effectiveness of Engineering Controls to Decrease the Exposure to Bloodborne Pathogens

Early attempts to control exposures to blood and body fluids focused on the use of safety guidelines and education, however, evidence indicated that this did not lead to fewer needlestick injuries. Engineering controls were recommended as a more effective way to control HCW exposures to blood and body fluids (29). Studies at the University of Virginia suggest that the redesign of hollow bore needle devices incorporating safety features that eliminate unnecessary needles, or shield hands from used needles, has the potential to prevent over 85% of needlesticks from those devices (422). "Sharps prevention technology" or safer devices are feasible and effective to significantly reduce the incidence of needlestick injuries and exposure to potentially fatal illness, e.g. the use of blunt needles reduced injuries by 87% when 50% of the suture needles used were blunt (38). Despite the potential for success, Jagger reports that in 1993-5 only 28% of hospitals have switched to safer intravenous catheters and less than 10% have switched to safer blood drawing needles (54).

Several studies have indicated that active safety devices can reduce percutaneous injury rates significantly. The pilot testing of a new safety syringe indicates that greater HCW acceptance would be achieved if safety devices provided protection automatically, rather than requiring an active safety mechanism that the HCW triggers to retract the needle (465). It is unknown why 1% of the passive safety features were not activated, however, if one does not push fully on the barrel, the safety feature does not receive the message to activate (421). This contrasts with active safety features where only 74% of the safety features for vacuum-tube blood collection needles were activated and only 60% of the winged steel needles were activated in a study for safer phlebotomy devices. With the safety active phlebotomy devices, 56% of health care workers sustained injuries before activation of the safety device was appropriate, 18% during activation. Twenty-two percent were not activated (432).

Among phlebotomists, nurses, medical students, and residents, percutaneous injuries occurring during phlebotomies can be reduced 41% by the use of safety devices; 82% for vacuum tube blood collection needles; and 16% for winged steel needles (432).

When conventional phlebotomy devices were replaced with active safety devices in six hospitals in Minneapolis-St. Paul, New York City, and San Francisco, percutaneous injury rates were significantly reduced (431). With one type of vacuum-tube blood-collection device, a reduction of 76% occurred and with a second type of vacuum-tube blood-collection device a 66% reduction occurred. A reduction of 23% was achieved with the usage of winged steel needles with a safety lock. These devices required activation by the HCW so further improvements can be anticipated with passive devices that provide automatic protection. Fifty-seven percent of the first type of vacuum-tube collection devices were activated as were 98% of the second type. Fifty-six percent of the winged steel needle devices were activated. Short-term complications in patients were clinically minimal and long-term complications from phlebotomies are unusual, as phlebotomy devices are not indwelling (431).

In addition, a shielded-stylet safety intravenous catheter reduced intravenous catheter related needlesticks by 83% (54). In anesthesia, an intravenous cannula that is actively retracted into the safety barrel resulted in no blood exposures when compared with a traditional 18-gauge needle (466).

Data from five hospitals participating in the U.S. National Surveillance System for Hospital Health Care indicated that in [ ] year, 98% of devices that caused percutaneous injuries did not have safety mechanisms (56).

Bryce, in a study at the Vancouver General Hospital, estimated that safety syringes used for intravenous or subcutaneous injections could have prevented 18% of the high risk injuries and 12% of the low risk ones (35). In contrast, needleless intravenous infusion sets would have prevented 3% of the high risk and 56% of the low risk injuries (35).

Many needleless systems have been developed to meet the need of controlling injuries with a lower risk for disease transmission, e. g. needles used to access intravenous equipment, for heparin/saline flushes or other intravenous line connections. Studies indicate the following results:

a. Needleless access systems in a small, public teaching hospital in California were able to reduce intravenous access-related needlesticks by 54% (427). When coupled with an 18% decrease from education, injuries were reduced by 72%.

b. In a Winnipeg study, the needleless access system was 78.7% effective in reducing intravenous line-related injuries. An overall reduction of 43.4% in total needlestick injuries from all procedures and events occurred. Not recapping was responsible for a 40.6% reduction of injuries and 40.7% of a reduction in injuries was related to disposal of needles (424). Needleless devices offer benefit over conventional systems when used as the access point for intravenous medications (467).

c. Other studies have also found the needleless access system effective (425,426,468). These results contrast with one study carried out in New Zealand where it was not proven effective (469).

d. A three-milliliter shielded safety syringe and a needleless intravenous system reduced needlestick injuries by 61% when compared with the six month period prior to the trial. The control group also had a similar reduction of injuries and therefore the change was not effective (470).

In 1999, the 70 hospitals in the Exposure Prevention Information Network database report noted that 26% of needlesticks were due to accessing intravenous equipment before the implementation of needleless and protected-needle intravenous systems but only 3% involved accessing intravenous equipment after that (54).

Although injuries caused from access to intravenous catheters represent a lower risk for disease transmission, in one U.S. university hospital that switched to needleless systems, the total number of injuries was reduced (33).

Sharps disposal units, a type of engineering control, placed on the walls near the patients in a major teaching hospital in California, reduced recapping by 27% in one unit and 18% in a second unit but made no significant change when the box was near the patient, but not on the wall (58).

Bryce, in a study at the Vancouver General Hospital, estimated that point-of-use sharps containers could have prevented 21% of the injuries in which the device was contaminated with blood or an infectious body fluid (35).

Many ideas have been generated to reduce exposures to HCWs as is demonstrated in the following Table VII:

Table VII: Safer Devices/Equipment to decrease risk of injury to HCWs

Device/Equipment	Replaces	Advantage	Study
Single-use disposable nozzle for jet injectors;	Multi-jet injector	Suitable for group immunizations	(471,472)*
Auto-destruct syringe and needle	Reuse of disposable needles	Suitable for group immunizations	(471,472)
Disposable, single-use lancet retracts into the holder	Non-retractable lancet	Effective for monitoring glucose levels	(473).
Segment sampling devices, slide preparation devices, sample collection cup, and a plastic finger-stick sampling blood collection tube		Decreases risk for laboratory workers working on blood samples	(474)
Blunt tip on the tip of a scalpel, skin clips or staples for skin closures, the ability to change a scalpel more safely with a device, e.g. forceps	Sharp scalpel tips, sharp towel clips and cautery tips in the operating room	Decreases opportunity for sharps injury	(475)
Use of a device to remove the blade from a scalpel, e.g. bins or magnetic surfaces		Loose scalpels are not found in operating room trays or drapes	(476)
Stapling allows rapid closing of the skin	Sutures	Hands are further away from the sharp	(476)
A retractable plastic sleeve for plastic syringes for local anesthetic	Reuse of needle and syringe with no protection	Allows their reuse and safe retention of the needle	(467)
Plastic capillary tubes, specimen tubes, and syringes	Glass tubes and syringes	Plastic will not break and expose the HCW to blood and potentially bloodborne pathogens	(442,467)
A closed system, e.g. for angiographic flush	A splash from blood emptied	Eliminates blood splash	(467)

	into bowl		
Port (Huber) needle removal devices, e.g. Forcep is used to pull on a protective device that fits on the hub of a port or a small plastic box slides over the needle shaft allowing the top to be pushed down to stabilize the port, and the HCW to pull up on either side of the device with the index and middle fingers to remove the needle in the box	Removal of Huber needle with hand	Prevents hollow blood-filled needle injury	(433)
Well designed, ergonomically suitable work station, e.g. phlebotomy station	Basic unit for blood-drawing	Decreases the likelihood of injuries	(477)

9. Effectiveness of Administrative Controls to Decrease the Exposure to Bloodborne Pathogens

Following a blood and body fluid exposure, lab testing of the source blood, if known, is recommended. Testing for bloodborne pathogens is voluntary and requires informed consent. Empowering HCWs with a role in obtaining consent may improve the timeliness and proportion of source blood that may be tested following an exposure and assist in effective follow-up of the HCW. In most Canadian hospitals (87.6%), it is a physician's responsibility to obtain consent for all HIV testing. A Calgary study done from 1989 – 1993 to assess an alternative system indicates that Infection Control Practitioners follow-up of known source patients with Occupational Health follow-up of employees could obtain consent and testing for HIV and HBV respectively from 67.9% and 87.6% of low risk patients and 82.3% and 92.2% of high-risk patients. Backup teams can successfully cover off-hours or areas where Infection Control Practitioners access is a problem (478).

An adequate ratio of patients to personnel should enable care to be given in a safer manner (47).

10. Effectiveness of Work Practices to Decrease the Exposure to Bloodborne Pathogens

10.1 Immunization

An intensive hepatitis B vaccination program in a Winnipeg hospital resulted in 26.2% of people achieving full immunization during the promotion period (370).

In areas not targeted for immunization in the hepatitis B vaccination program of a Winnipeg hospital, there was a 6% decrease in overall vaccination rate leading one to conclude that self-initiated participation may be ineffective (370).

10.2 Safer handling of sharp devices

Used needles should never be recapped or otherwise manipulated with both hands. If recapping cannot be avoided, either a single-handed 'scoop method' or a mechanical device designed for holding the needle sheath should be employed (7). Not recapping in Winnipeg was responsible for a 40.6% reduction of injuries and 40.7% of a reduction in injuries was related to disposal of needles (424). Data from about 70 hospitals in the Exposure Prevention Information Network database indicates injuries with recapping needles has decreased from 25% to 4% over the last decade (54).

Literature suggests that the person who uses the sharp is responsible for the disposal (7).

Tissue retraction using a free hand is associated with increased injuries (393,479). The following procedural changes in the operating room have been associated with a decrease in injuries:

- Using scissors instead of a scalpel (476).
- Shielding the scalpel blade or clamping the sharp tip of a needle in a needle holder before returning it to a co-worker [ ]
- Holding the suture needle with forceps (479).
- Increasing the length of the forceps or retractors to decrease the likelihood of striking the hand that holds the retractors (479).
- Tying a suture with a suture thread that is sufficiently long so the needle is guarded by a needle holder and not the palm of the hand
- Using a cotton outer glove over the latex one when working with wire sutures (479)
- Minimizing sharp equipment in the field unless it is being used, e.g. suture needles, needle holders, scalpels, hypodermic needles, and all other sharp instruments (479).

Other work practice changes in the operating room have been associated with a decrease in injuries:

- Notification of the surgeon by the assistant before moving hands in the operative field prevents injury (35,467,479).
- Minimal access surgery reduces the usage of wide, open wounds with fingers and instruments in close proximity thus decreasing the injuries of HCWs (476).
- The use of a "no-touch" or "hands-free" technique (437,476) or "safety-passing zone" (475) to avoid injuring another HCW during procedures in the operating room or treatment room is a simple, effective method that has a very low cost (35).

- Adequate lighting is necessary in areas where procedures involving sharp instruments, are performed, e.g. in the operating room and radiology (467) in order to enable direct visualization of the hands and instruments when the wound is being closed with the goal of reducing injuries (479).

Dental surgeons are at higher risk of percutaneous exposures to bloodborne pathogens if they do not use "no touch" techniques (446).

Implementation of hospital wide availability of safety intravenous catheters rather than implementation in selective clinical areas only is more likely to prevent exposures (441).

The location of sharps-disposal bins at the point of use and disposal when no more than 2/3 full decreases likelihood of injuries (480) The Canadian Standards Association document states that the puncture resistant container is to be filled to no more than ¾ capacity. The standard also is in place for color coding, labeling, and strength (37). Having bins available from pocket size to 26 litres facilitates disposal appropriate to the work place.

11. Effectiveness of Personal Protective Equipment to Decrease the Exposure to Bloodborne Pathogens

The choice of personal protective equipment depends on the procedure to be done and the likelihood of being exposed to blood or body fluids (467).

Over a two year period, 74% of clinical laboratory workers reported mucocutaneous exposures of blood to areas of the face, including the eyes and nose. Face shields that attach from the top of a mask rather than those that rest on the forehead and are open below provide more protection and improved visibility (467).

Hospital operating rooms differ significantly from other sites in their frequency and types of blood exposures and requirements for protective equipment (411), Liquid-proof or liquid-resistant gowns or coats offer increased protection where there is a risk of splashing or spraying of blood or body fluids compared to cloth lab coats.

Glove materials decreased the volume of blood transferred in a paper-model and a tissue-model by 46-86% when compared with no gloves (60).

When double gloves were worn during surgery, the incidence of skin contamination was reduced 50% (481).

Mouthpieces and other ventilation devices offer protection in procedures where exposure to respiratory secretions is likely (467).

Canadian dental surgeons are at higher risk of mucutaneous exposures if they do not wear eye protection in the clinic/ward and operating room (446).

12. Effectiveness of Education to Decrease the Exposure to Bloodborne Pathogens

Skolnick found a decrease in needlestick injuries of 18% following an education campaign. (427).

At the University of Cincinnati from 1986-1988, an educational program to reduce needlestick injuries emphasized the importance of not recapping, sharps disposal containers, and the use of universal precautions. The only decrease in needlestick injuries occurred in the nursing group due to the reduction of recapping from 25% to 13% that was associated with the installation of sharps disposal containers (482).

In a retrospective study of sharps injuries over a 1 year period in Vancouver General Hospital, it was considered that retaining an education coordinator would provide the most cost-effective method of reducing injuries (35). The study projected that 59% of high risk injuries and 25% of low risk injures could be prevented.

13. Effectiveness of Evaluation to Decrease the Exposure to Bloodborne Pathogens

To be an advocate for a safer workplace, one needs as much supporting data as possible (54). Underreporting of potential bloodborne pathogen exposures may lead to biased estimates on the rate of seroconversions, inaccurate conclusions about the cause of the injuries, lack of appropriate management of an exposure including prophylaxis, and lack of knowledge of effectiveness of post-exposure prophylaxis (354,452).

Following the Montreal study of blood and body fluid exposures in HCWs in non-hospital settings from 1992-1993, the recommendation was made to reinforce the reporting system by the use of a standard collection tool and by providing adequate post-exposure services to all HCWs (355). It was also recommended to implement a surveillance network of exposures to allow for the aggregation of all data from health care settings that would increase sample size to permit more refined data analysis (355) and allow for comparison between institutions (34). Since this time, a surveillance system has been implemented in 16 hospitals in Quebec and 13 pilot sites across Canada [see Appendix 4]. Knowing the cause of the injuries, the type of injury, and the effectiveness of the management of an exposure including prophylaxis, enables the institution to implement corrective actions to reduce the risk to HCWs.

Exposure Prevention Information Network, a standardized surveillance system that analyzes injuries, is being conducted in at least 7 countries. A modified version is now being used in Canada [see Appendix IV].

In addition, the U.S. National Surveillance System for Hospital Health is a surveillance system designed by the Centers for Disease Control to track bloodborne and vaccine-preventable occupational exposures and infections among the hospital-based HCWs in the United States (483).

APPENDIX IV: CANADIAN NEEDLE STICK SURVEILLANCE SYSTEM (CNSSN)

Goal: Integrate the existing HIV occupational sharps exposure database with a hepatitis B and hepatitis C database that has been developed for Health Canada in Quebec.

Background :
Needlestick exposures are the most common preventable cause of occupational bloodborne exposure. A reliable national database is essential to describe the incidence of occupational seroconversions of hepatitis B and C in Canada. This will enable ongoing development and evaluation of prevention and control strategies both nationally and in the provinces and territories. It will integrate the existing HIV occupational sharps exposure database with a hepatitis B and hepatitis C database that has been developed for Health Canada in Quebec.

Surveillance Purpose :
To collect surveillance data from a representative sample of HCFs to permit valid estimation of the magnitude of occupational bloodborne (BBP) seroconversions of HCWs with regards to hepatitis B and hepatitis C.

To estimate the magnitude of morbidity, mortality and cost burden of hepatitis B and C among HCWs due to their occupation.

To encourage collection and analysis of occupational hepatitis B and hepatitis C seroconversions of HCWs by the Division of Nosocomial and Occupational Infections from sites across Canada.

Surveillance Method : Work site managers will utilize the WinSISSES software program, developed with support from Health Canada, to implement an Integrated Surveillance System for occupational Exposures to body fluids and Seroconversions to hepatitis B (HBV), hepatitis C (HCV), and human immunodeficiency (HIV) viruses (ISSES).

Method of Surveillance Data Collection : Work site managers will send data without personal identifiers to the Division of Nosocomial and Occupational Infections for analysis.

Distribution/Release plans : A summary report will be prepared twice yearly following data collection.

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GLOSSARY

Additional Precautions	Interventions implemented for certain pathogens or clinical presentations in addition to routine infection control practices to reduce the risk of transmission of microorganisms from patient-to-patient; patient to HCW, and HCW to patient (1).
Antiseptic	A product with antimicrobial activity that is designed for use on skin or other superficial tissues, removes both transient and resident flora. The term is used for preparations applied to living tissues (1).
Colonization	Presence of microorganisms in or on a host with growth and multiplication but without tissue invasion or cellular injury (1).
Communicable	Capable of being transmitted from one person to another; synonymous with "infectious" and contagious" (1).
Disease	Clinical expression of infection; signs and/or symptoms are produced (1).
Exposure	The condition of being subjected to an infectious disease in a manner that enables transmission to occur.
Emergency Responders	Ambulance, Fire, Policef and Paramedic workers (13,73-75).
Exclude from work (Unfit for work)	define as "restrict from patient care tasks, coworker contact and restriction from the workplace"
Exposure Prone Exposures	procedures during which transmission of HBV, HCV or HIV from a HCW to patients is most likely to occur and includes the following: a) digital palpation of a needle tip in a body cavity (a hollow space within the body or one of its organs or the simultaneous presence of the HCW's fingers and a needle or other sharp instrument or object in a blind or highly confined anatomic site, e.g. during major abdominal, cardiothoracic, vaginal and/or orthopedic operations, or b) repair of major traumatic injuries, or c) major cutting or removal of any oral or perioral tissue, including tooth structures, during which there is a potential for the patient's open tissues to be exposed to the blood of an injured HCW [5011].

Fit for Work	accepted terminology used in occupational health to communicate a worker's ability to remain/return to work. Phrase is one of 3 qualifiers; fit for work, unfit for work, fit with restrictions. Allows occupational health nurse to maintain confidentiality about workers diagnosis, symptoms, immune status etc.
Fit with restrictions	allows for reassignment of duties or reintegration into the workplace in a manner that will not pose an infection control risk to the HCW or to the individuals in the workplace.
Health care workplace	The hospital, building, agency, or area, e.g. ambulance, where health care is provided.
Health Care Worker (HCW)	An individual who may have the potential to acquire or transmit an infectious agent during the course of his/her work in the health care workplace, e.g. nurses, residents, physicians, researchers, volunteers and emergency responders.
Immunocompromised	Increased susceptibility to infection. In this document the term refers to patients with congenital or acquired immunodeficiency due to chemotherapeutic agents or hematologic malignancies (1).
Infection	The entry and multiplication of an infectious agent in the tissues of the host. a) Inapparent (asymptomatic, subclinical) infection: an infectious process running a course similar to that of clinical disease but below the threshold of clinical symptoms b) Apparent (symptomatic, clinical) infection: one resulting in clinical signs and symptoms (disease) (1).
Infectious	Caused by infection or capable of being transmitted (1).
Nosocomial	Infection acquired by a patient in a health care setting.
Outbreak	An excess over the expected incidence of disease within a geographic area during a specified time period, synonymous with epidemic (1).
Routine Practices	Infection control practices used in the care of all patients to reduce the risk of transmission of microorganisms from patient-to-patient; patient-to-HCW and HCW to patient.
Sharps Injuries	Injuries caused by percutaneous injuries or cuts.
Source Person	The person, animal, object or substance from which an infectious agent passes to a host (22).

9538		
9539	Template	Occupational Health pattern to follow for input/retrieval of
9540		information. For this information see Table I.

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